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U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

A. W. HARRIS, DIRECTOR

EXPERIMENT STATION BULLETIN No. 7

PROCEEDINGS

OF THE

FIFTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

WASHINGTON, D. C.

AUGUST 12–18, 1891

EDITED BY

A. W. HARRIS, for the Office of Experiment Stations,

AND

H. E. ALVORD, for the Executive Committee of the Association

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

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LOCATIONS AND DIRECTORS OF THE AGRICULTURAL EXPERIMENT STATIONS.

ALABAMA—*Auburn:* W. L. Broun, LL. D.* *Uniontown:* Canebrake Station; W. H. Newman, M. S.† *Athens:* North Alabama Station; R. E. Binford, M. A. *Abbeville:* Southeast Alabama Station; D. Gillis, M. S.

ARIZONA—*Tucson:* F. A. Gulley, M. S.

ARKANSAS—*Fayetteville:* R. L. Bennett, B. S.

CALIFORNIA—*Berkeley:* E. W. Hilgard, LL. D.

COLORADO—*Fort Collins:* W. J. Quick, B. S.

CONNECTICUT—*New Haven:* State Station; S. W. Johnson, M. A. *Storrs:* Storrs School Station; W. O. Atwater, Ph. D.

DELAWARE—*Newark:* A. T. Neale, Ph. D.

FLORIDA—*Lake City:* J. P. DePass.

GEORGIA—*Experiment:* R. J. Redding.

ILLINOIS—*Champaign:* G. E. Morrow, M. A.*

INDIANA—*La Fayette:* C. S. Plumb, B. S.

IOWA—*Ames:* James Wilson.

KANSAS—*Manhattan:* G. T. Fairchild, M. A.‡

KENTUCKY—*Lexington:* M. A. Scovell, M. S.

LOUISIANA—*Audubon Park, New Orleans:* Sugar Station. *Baton Rouge:* State Station. *Calhoun:* North Louisiana Station. W. C. Stubbs, Ph. D., is director of the three stations.

MAINE—*Orono:* W. H. Jordan, M. S.

MARYLAND—*College Park:* H. E. Alvord, C. E.

MASSACHUSETTS—*Amherst:* State Station; C. A. Goessmann, LL. D. *Amherst:* Hatch Station; H. H. Goodell, LL. D.

MICHIGAN—*Agricultural College:* O. Clute, M. S.

MINNESOTA—*St. Anthony Park:* C. D. Smith, M. S.

MISSISSIPPI—*Agricultural College:* S. M. Tracy, M. S.

MISSOURI—*Columbia:* E. D. Porter, Ph. D.

NEBRASKA—*Lincoln:* H. H. Nicholson, M. A.

NEVADA—*Reno:* S. A. Jones, Ph. D.

NEW HAMPSHIRE—*Hanover:* G. H. Whitcher, B. S.

NEW JERSEY—*New Brunswick:* State and College Stations; James Neilson.§

NEW MEXICO—*Las Cruces:* H. Hadley, M. A.

NEW YORK—*Geneva:* State Station; P. Collier Ph. D. *Ithaca:* Cornell University Station; I. P. Roberts, M. Agr.

NORTH CAROLINA—*Raleigh:* H. B. Battle, Ph. D.

NORTH DAKOTA—*Fargo:* H. E. Stockbridge, Ph. D.

OHIO—*Columbus:* C. E. Thorne.

OKLAHOMA—*Stillwater:* J. C. Neal, M. D.

OREGON—*Corvallis:* H. T. French, M. S.§

PENNSYLVANIA—*State College:* H. P. Armsby, Ph. D.

RHODE ISLAND—*Kingston:* C. O. Flagg, B. S.

SOUTH CAROLINA—*Fort Hill:* H. A. Strode.

SOUTH DAKOTA—*Brookings:* L. Foster, M. S. A.

TENNESSEE—*Knoxville:* F. Lamson-Scribner, B. S.

TEXAS—*College Station:* G. W. Curtis, M. S. A.

UTAH—*Logan:* J. W. Sanborn, B. S.

VERMONT—*Burlington:* W. W. Cooke, M. A.

VIRGINIA—*Blacksburg:* J. M. McBryde, LL. D.

WASHINGTON—*Pullman:* G. Lilley, LL. D.

WEST VIRGINIA—*Morgantown:* J. A. Myers, Ph. D.

WISCONSIN—*Madison:* W. A. Henry, B. Agr.

WYOMING—*Laramie:* A. A. Johnson, D. D.

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*President of board of direction. †Assistant director in charge. ‡Chairman of council. §Acting director.

OFFICE OF EXPERIMENT STATIONS.—Director, A. W. Harris; Assistant Director, A. C. True; Special Agent for European work and Consulting Expert, W. O. Atwater; Assistant Editors, E. W. Allen (foreign work) and W. H. Beal (index); Librarian and Record Clerk, S. L. Sommers.

Communications intended for this Office should be addressed to the SECRETARY OF AGRICULTURE, for the *Office of Experiment Stations, Department of Agriculture, Washington, D. C.*

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
December 22, 1891.

SIR: I have the honor to transmit herewith for publication Experiment Station Bulletin No. 7 of this Office, containing the proceedings of the fifth annual convention of the Association of American Agricultural Colleges and Experiment Stations, held at Washington, D. C., August 12–18, 1891. The lectures delivered by Mr. R. Warington, F. R. S., of Rothamsted, England, are printed in separate form as Experiment Station Bulletin No. 8. The stenographic report of this meeting was made by Mr. Talma Drew, official stenographer of this Department, who also largely assisted in the editing.

Very respectfully,

A. W. HARRIS,
Director.

Hon. J. M. RUSK,
Secretary of Agriculture.

CONSTITUTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

NAME.

This Association shall be called The Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association.

MEMBERSHIP.

At any regularly called meeting of the Association each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, the United States Department of Agriculture, and the Office of Experiment Stations of the United States Department of Agriculture shall be entitled to one delegate. The same delegate may represent both a college and an experiment station, and may take part in the proceedings of the sections proper to either or both, but no delegate shall cast more than one vote either in a section or in convention. Other institutions engaged in experimental work in the interest of agriculture may be admitted to representation in this Association by a majority vote at any regular meeting of the Association.

Any person engaged in agriculture, who shall attend the conventions of this Association, not as a delegate, may, by vote of the convention, be admitted to all the privileges of the floor, except the right to vote.

OFFICERS.

The officers of this Association shall be a president, five vice presidents, and a secretary, who shall act as treasurer. They shall be chosen by ballot and shall perform the duties which usually devolve upon such officers. They shall hold office from the close of the meeting at which they were elected and until their successors shall be elected.

The president, secretary, and five persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

The executive committee shall determine the time and place of the meetings of the Association; shall issue its call for said meetings, stating the general purpose thereof, not less than 30 days before the date at which they shall be held; shall provide a well-prepared order of business and program of exercises for such meetings; and shall make seasonable issue of said programs.

It shall be the duty of each institution included in this Association to present at each regularly called meeting a brief report of the work and progress of said institution, and such report shall be called for in the regular order of business.

The executive committee shall be charged with the general arrangement and conduct of the meetings called by it, at which meetings, before adjournment, a new executive committee shall be chosen.

SECTIONS.

The Association shall be organized into sections upon the several classes of special subjects, the consideration of which shall become desirable. Each institution represented in the Association shall be entitled to representation in each section by one delegate. Each section shall nominate to the convention a chairman, to hold office until the close of the next convention. Each chairman shall present at the first general session of the convention a report of progress in his subject during the preceding year, together with any other facts connected therewith which he may deem of interest. Such reports shall not exceed 15 minutes in length. The annual address of the president of the Association shall be given upon the evening of the same day. Provision shall be made in the program for meetings of each of the sections, either simultaneously or consecutively, as the executive committee shall determine. At least two sections shall each year present in general sessions of the convention a portion of the subjects coming before them. The sections to thus report shall be designated by the executive committee, and general notice of the selection shall be given at least 3 months in advance. There shall be sections on agriculture, on botany, on chemistry, on college work, on entomology, and on horticulture, and the executive committee, upon request of any five institutions represented in the Association, shall provide for the organization of new sections at any convention.

AMENDMENTS.

This constitution may be amended at any regularly called meeting by a vote of two thirds of the delegates present.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the program.

(3) Speakers invited to open discussions shall be entitled to 20 minutes each.

(4) In general discussions the 10-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general program shall be closely observed, unless changed by a two thirds vote of delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

OFFICERS OF THE ASSOCIATION.

ELECTED AT CHAMPAIGN, ILLINOIS, NOVEMBER, 1890.

President,

H. H. GOODELL of Massachusetts.

Vice Presidents,

O. CLUTE of Michigan,
A. Q. HOLLADAY of North Carolina,
J. W. SANBORN of Utah,
I. P. ROBERTS of New York,
E. D. PORTER of Missouri.

Secretary and Treasurer,

M. A. SCOVELL of Kentucky.

Executive Committee,

The PRESIDENT, the SECRETARY,
H. E. ALVORD of Maryland,
J. H. SMART of Indiana,
M. C. FERNALD of Maine,
J. A. MYERS of West Virginia,
W. M. HAYS of Minnesota.

Chairmen of Sections,

Agriculture, C. S. PLUMB of Indiana;
Botany, B. D. HALSTED of New Jersey;
Chemistry, A. T. NEALE of Delaware;
College Work, G. W. ATHERTON of Pennsylvania;
Entomology, A. J. COOK of Michigan;
Horticulture, E. S. GOFF of Wisconsin.

ELECTED AT WASHINGTON, D. C., AUGUST, 1891.

President,

W. L. BROUN of Alabama.

Vice Presidents,

C. W. DABNEY, jr., of Tennessee,
J. W. NICHOLSON of Louisiana,
H. E. STOCKBRIDGE of North Dakota,
F. E. EMERY of North Carolina,
W. H. JORDAN of Maine.

Secretary and Treasurer,

M. A. SCOVELL of Kentucky.

Executive Committee,

The PRESIDENT, the SECRETARY,
H. E. ALVORD of Maryland,
H. H. GOODELL of Massachusetts,
J. A. MYERS of West Virginia,
W. FREAR of Pennsylvania,
A. T. NEALE of Delaware.

Chairmen of Sections,

Agriculture, C. L. INGERSOLL of Nebraska; College Work, E. M. TURNER of West Virginia;
Botany, G. F. ATKINSON of Alabama; Entomology, L. BRUNER of Nebraska;
Chemistry, M. A. SCOVELL of Kentucky; Horticulture, E. A. POPENOE of Kansas;

Secretaries of Sections,

Agriculture, T. F. HUNT of Pennsylvania; College Work, H. E. STOCKBRIDGE of North Dakota;
Botany, L. H. PAMMEL of Iowa; Entomology, F. M. WEBSTER of Ohio;
Chemistry, H. H. HARRINGTON of Texas; Horticulture, T. L. BRUNK of Maryland.

CALL FOR THE CONVENTION.

ASSOCIATION OF AMERICAN AGRICULTURAL
COLLEGES AND EXPERIMENT STATIONS,
OFFICE OF THE EXECUTIVE COMMITTEE,
College Park, Maryland, July 1, 1891.

By authority of the executive committee, a delegate convention of this Association is hereby called to meet at the Columbian University, Washington, D. C., on Wednesday, August 12, 1891, at 10 a. m.

In accordance with the requirements of the constitution, the sections on agriculture and on entomology are hereby designated to present a portion of the subjects coming before them in the general sessions of the convention.

The chairmen of the several sections will each be called upon for a report of progress, not to exceed 15 minutes in length, on Wednesday, the first day of general sessions.

The first course of lectures in America under the Rothamsted trust, established by Sir John Bennet Lawes, Bart., to be delivered by Mr. R. Warington, F. R. S., chemist and accredited representive of Rothamsted, under the auspices of this Association and upon its special invitation, will constitute the prominent feature of this convention. No other matter will be allowed to conflict with the assignments for these six lectures, and other scientific associations meeting in Washington on some of the days named have arranged their work so as to allow all their members to attend these lectures.

All delegates and others intending to attend this convention are urged to apply to Prof. M. Baker, local secretary of the American Association for the Advancement of Science, Washington, D. C., for a circular announcing the August meeting of the American Association for the Advancement of Science and the other scientific bodies meeting in Washington about the same time. Many advantages will be derived from at once joining the American Association for the Advancement of Science. The Association of Official Agricultural Chemists meets August 13, 14, and 15. The Society for the Promotion of Agricultural Science meets August 17 and 18. For botanical, chemical, and entomological meetings, see the circular mentioned.

For the executive committee,

HENRY E. ALVORD,
Chairman.

PROGRAMS.

All sessions will be held at the Columbian University, southeast corner Fifteenth and H streets.

ASSIGNMENT OF ROOMS.

All general sessions and evening lectures in the law lecture room, No. 12, first floor.

Sectional meetings on the second floor: Section on botany in room No. 18, section on entomology in room No. 15, section on horticulture in room No. 14, section on college work in room No. 17.

Sectional meetings on the third floor: Section on agriculture in room No. 31 (the chemical lecture room), section on chemistry in room No. 28.

Hours for meetings: 9 a m., 2 p. m., and 8 p. m.

SPECIAL NOTICE.

The chairmen and secretaries of sections are requested to hand to the secretary of the Association, in advance, written announcements of the section meetings from day to day. Also to preserve such records of the section meetings as will serve for a correct journal of their proceedings.

WEDNESDAY, AUGUST 12, 1891.

10 a. m.—General session. Organization and reports of committees; reports from the chairmen of sections.

2 p. m.—General session. Reports concluded and discussions on these questions: (*a*) Is it desirable to have a collective exhibit of the agricultural colleges in the agricultural building of the World's Columbian Exposition? (*b*) What coöperation is desirable between the colleges and stations and the Weather Bureau of the Department of Agriculture? (*c*) Shall this convention hold an adjourned session at some other place the present year?

8 p. m.—Opening address by the president of the Association, H. H. Goodell, LL. D., president Massachusetts Agricultural College. First lecture of the Rothamsted course, by R. Warington, F. R. S., vice president Chemical Society of England; subject, The Rothamsted Experimental Station, illustrated with lantern.

THURSDAY, AUGUST 13.

9 a. m. and 2 p. m.—Meetings of the sections on agriculture and botany, and others if desired, excepting the section on chemistry.

8 p. m.—General session for business, not to exceed 1 hour. Second Rothamsted lecture, subject, The Circumstances which Determine the Rise and Fall of Nitrogenous Matter in the Soil.

FRIDAY, AUGUST 14.

9 a. m. and 2 p. m.—Meetings of the sections on horticulture and college work, and others if desired, excepting the section on chemistry.

8 p. m.—General session, not to exceed 1 hour. Subjects presented from the section on agriculture. Third Rothamsted lecture, subject, Nitrification, illustrated.

SATURDAY, AUGUST 15.

9 a. m.—Meeting of section on entomology, and other sections if desired.

2 p. m.—General session. Election of officers and other business. Fourth Rothamsted lecture, subject, Nitrification and Denitrification, illustrated with lantern.

MONDAY, AUGUST 17.

8 p. m.—General session. Subjects from the section on entomology. Fifth Rothamsted lecture, subject, Nitrification of Soils and Manures, with diagrams.

TUESDAY, AUGUST 18.

8 p. m.—General session. Final business from the sections. Sixth Rothamsted lecture, subject, Drainage and Well Waters. Closing business. Adjournment.

SECTION ON AGRICULTURE.

C. S. PLUMB, Chairman. C. E. THORNE, Secretary.

(1) How may fiber plants be studied to best advantage? C. D. Smith of Minnesota.

(2) How many cattle should be used in a feeding experiment? F. A. Gulley of Arizona.

(3) Physical conditions surrounding animals in experimental feeding, especially as related to stalls and mangers, W. A. Henry of Wisconsin.

(4) Model coöperative plat work, W. P. Brooks of Massachusetts.

(5) How can the results of work be most successfully presented to the farmer? I. P. Roberts of New York.

(6) Experimental work of importance to coast line States, as affected by maritime conditions, C. O. Flagg of Rhode Island.

(7) Soil features that should be recognized in all plat work, M. Whitney, of Maryland.

(8) The relation of teaching to experimental work, G. E. Morrow of Illinois, H. E. Alvord of Maryland, and J. S. Newman of Alabama.

(9) Implement tests and use of the dynamometer, J. W. Sanborn of Utah.

(10) What should be the duties of a station agriculturist? For open discussion.

(11) State soil surveys, how far are they practicable and how should they be conducted? E. W. Hilgard of California and M. Whitney of Maryland.

(12) Variety testing in cereals, how can it be rendered more decisive? C. L. Ingersoll of Nebraska and J. F. Hickman of Ohio.

No other sectional program has been received in time to distribute before the convention.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

The following is a list of delegates and visitors in attendance as finally reported by the executive committee, acting as a committee on credentials:

Alabama:

College: N. T. Lupton,* chemist; W. L. Broun, president. *Station* (Auburn): G. F. Atkinson,* biologist; J. T. Anderson, assistant chemist; J. F. Wilkinson, assistant chemist.

Arizona:

College: C. B. Collingwood,* chemist. *Station:* F. A. Gulley,* director.

Arkansas:

Station: G. L. Teller,* chemist.

California:

Station: E. W. Hilgard,* director.

Colorado:

College: W. J. Quick,* agriculturist; R. A. Southworth, board of agriculture. *Station:* C. S. Crandall, botanist and horticulturist.

Connecticut:

Sheffield School: W. H. Brewer,* professer of agriculture. *State Station:* E. H. Jenkins,* vice director; W. C. Sturgis, mycologist. *Storrs School:* C. S. Phelps,* professor of agriculture. *Storrs Station:* C. D. Woods,* chemist.

Delaware:

College: A. N. Raub,* president; C. L. Penny, chemist; G. A. Harter, meteorologist. *Station:* A. T. Neale,* director; M. H. Beckwith, horticulturist and entomologist.

Florida:

N. Robinson.

Illinois:

College: G. E. Morrow,* professor of agriculture. *Station:* E. H. Farrington,* chemist; J. C. Arthur, botanist.

Indiana:

Station: C. S. Plumb,* director; H. A. Houston, chemist.

Iowa:

College: H. Osborn,* zoölogist and entomologist; G. E. Patrick, chemist; L. H. Pammel, botanist.

Kansas:

College: J. E. Hessin,* governing board. *Station:* E. A. Popenoe,* horticulturist and entomologist.

Kentucky:

College: H. Gibson,* secretary of board of trustees. *Station:* M. A. Scovell,* director and chemist; H. Garman, entomologist and botanist.

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* Delegate.

Louisiana:

College: J. W. Nicholson,* president. *Station:* W. C. Stubbs,* director; B. B. Ross, chemist.

Maine:

College: W. H. Jordan,* chemist. *Station:* J. M. Bartlett,* chemist.

Maryland:

College: H. E. Alvord,* president; M. Whitney, professor of soil physics; H. B. McDonnell, agricultural chemist; E. W. Doran, professor of zoölogy. *Station:* T. L. Brunk,* horticulturist; H. J. Patterson, chemist; A. I. Hayward, agriculturist.

Massachusetts:

College: H. H. Goodell,* president.

Michigan:

College: W. J. Beal,* botanist. *Station:* A. J. Cook,* entomologist; R. C. Kedzie, chemist.

Minnesota:

College: D. N. Harper,* agricultural chemist. *Station:* C. D. Smith,* director.

Mississippi:

College: J. H. Connell,* professor of agriculture. *Station:* S. M. Tracy,* director; L. G. Patterson, chemist. *Alcorn College:* J. D. Burrus,* professor of agriculture.

Missouri:

College: E. D. Porter,* professor of agriculture. *Station:* J. W. Clark,* horticulturist; H. J. Waters, assistant agriculturist.

Nebraska:

College: C. L. Ingersoll,* professor of agriculture. *Station:* H. H. Nicholson,* director; L. Bruner, entomologist.

New Hampshire:

College: C. H. Pettee,* dean. *Station:* F. W. Morse,* chemist; H. H. Lamson, botanist and bacteriologist.

New Jersey:

College: A. Scott,* president; B. D. Halsted, professor of botany. *State Station:* E. B. Voorhees,* chemist; L. A. Voorhees, chemist; J. P. Street, chemist. *College Station:* J. B. Smith,* entomologist; C. S. Cathcart, assistant chemist.

New Mexico:

College: J. A. Whitmore,* trustee. *Station:* A. E. Blount,* agriculturist.

New York:

College: I. P. Roberts,* professor of agriculture.

North Carolina:

College: F. E. Emery,* professor of agriculture; W. A. Withers, professor of agricultural chemistry. *Station:* H. B. Battle,* director; B. W. Kilgore, assistant chemist; F. B. Carpenter, assistant chemist.

North Dakota:

College: H. E. Stockbridge,* president.

Ohio:

College: W. H. Scott,* president; W. R. Lazenby, professor of horticulture; L. B. Wing, trustee. *Station:* C. E. Thorne,* director; J. F. Hickman, agriculturist; N. W. Lord, professor of mining and metallurgy; F. M. Webster, entomologist.

Pennsylvania:

College: T. F. Hunt,* professor of agriculture; W. H. Caldwell, professor of agriculture. *Station:* H. P. Armsby,* director; W. Frear, chemist.

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* Delegate.

Rhode Island:

Station: H. J. Wheeler,* chemist.

South Dakota:

College: J. H. Shepard,* professor of chemistry; C. A. Cary, veterinarian. *Station:* L. Foster,* director.

Tennessee:

College: C. W. Dabney, jr.,* president. *Station:* C. F. Vanderford,* agriculturist; F. Lamson-Scribner, director and botanist.

Texas:

College: J. E. Hollingsworth,* commissioner of agriculture. *Station:* G. W. Curtis,* director; D. Adriance, meteorologist; H. H. Harrington, chemist.

Vermont:

College: M. H. Buckham,* president. *Station:* W. W. Cooke,* director; L. R. Jones, botanist.

Virginia:

College: W. B. Alwood,* professor of horticulture; C. Ellis, veterinarian. *Station:* R. J. Davidson,* chemist. *Hampton Institute:* J. W. Hatch,* agriculturist and horticulturist.

West Virginia:

College: E. M. Turner,* president. *Station:* J. A. Myers,* director; D. D. Johnson, agriculturist; R. De Roode, chemist.

Wisconsin:

College: W. A. Henry,* professor of agriculture. *Station:* S. M. Babcock,* chemist.

Wyoming:

College: A. A. Johnson,* president.

U. S. Department of Agriculture:

E. Willits,* Assistant Secretary; H. W. Wiley, chemist; A. L. Colton and A. G. McAdie, Weather Bureau. *Office of Experiment Stations:* A. W. Harris,* director; E. W. Allen, editor; W. H. Beal, editor.

England:

R. Warington, chemist, Rothamsted.

Canada, Guelph, Ontario:

College: J. Mills, president; J. Fletcher, entomologist.

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* Delegate.

PROCEEDINGS.

Morning Session, Wednesday, August 12, 1891.

The convention was called to order at 10:30 a. m., in the law lecture room of the Columbian University, by President Goodell.

The report of the executive committee was submitted by H. E. Alvord, chairman.

Report of the Executive Committee for the Nine Months Ending August 12, 1891.

Immediately after the adjournment of the convention of the Association at Champaign in November, 1890, the executive committee were called together and organized by the choice of H. E. Alvord as chairman and M. A. Scovell as secretary.

This committee has endeavored to perform its duty as defined by the constitution and the instructions of the last convention, and having made arrangements for the convention of 1891, now respectfully presents the following report:

At the time of the Champaign convention the executive committee was obliged to report that the Association had heavy liabilities for expenses necessarily incurred during the year previous, which it was unable at that time to discharge. Accordingly the convention of 1890 directed that every college eligible to membership in the Association be requested to contribute $25 to the Association treasury for the year 1891, and every experiment station the sum of $10, and that these payments be made prior to July 1, 1891. Notwithstanding the fact that several institutions that are quite willing to accept whatever benefits may be derived from the Association still fail to contribute to its support and the additional fact that less than 9 months have elapsed since the adjournment of the last convention, the contributions have been so general and so prompt that our energetic Treasurer is able to report all the old debts paid and a good balance on hand. The Treasurer's report will show that he received from his predecessor the sum of $146.52 and collected $1,570, making the total receipts $1,716.52. Of this there has been disbursed the sum of $1,407.03, leaving a balance of $309.49 on hand at the time of closing the accounts. Several additional contributions are promised soon on this year's account. There are some unpaid special committee expenses and the expenses attending this convention to be paid soon, but it appears certain that the business of the present calendar year can be closed and all obligations discharged without any additional call for funds.

Anticipating no extraordinary expenses for the year 1892, it is recommended that the present convention should authorize an invitation to every institution eligible to membership to contribute $10 to the treasury of the Association for the purpose of defraying the necessary expenses of the year 1892, and that the same be paid as early as practicable in that year.

Since the last convention this committee has transacted a good deal of business with the departments of the Government at Washington on behalf of the Association, some of it being of special importance to the colleges. It has also assisted in procuring by Congressional appropriation additional means for the Office of Experiment

Stations of the Department of Agriculture, for the special purpose of facilitating the preparation of an index of the literature of experimental agriculture. Some matters of importance are still pending at the Interior Department which can be more appropriately reported to the section on college work.

During the last 9 months the committee has printed and distributed five circulars of information, and these have been sent to all institutions eligible to representation here, whether or not they have sent delegates to the conventions heretofore held or assisted in the work of the Association.

The resolutions passed by the Champaign convention as an acknowledgment of the eminent services of Senator Justin S. Morrill have been duly engrossed, suitably framed, and transmitted to the Senator at his home in Vermont. A duplicate has been retained.

The Association at its last convention directed that an invitation be extended to Sir John Bennet Lawes to cause a series of lectures upon the work at Rothamsted to be delivered in America during the present year by his chosen representative and under the auspices of this Association. This invitation was accepted, and Mr. R. Warington, Fellow of the Royal Society of England and vice president of the Chemical Society, was designated to perform this duty. The time and place of this convention was determined by the committee mainly with reference to accommodating the delegate from Rothamsted and securing favorable conditions for the delivery of this first course of lectures in America by one of the principal participants in the famous work of Lawes and Gilbert.

No duty performed by the present executive committee during its existence has been found so perplexing as the decision as to the time and place for holding this convention. Although the constitution gives the committee full power over this subject and the last convention by most considerate action refrained from giving instructions in the premises, it has been the desire and purpose of the committee to respect the views and preferences of all likely to be delegates or in attendance, as far as practicable, and at the same time to serve the general interests of the Association. The committee fully appreciates the fact that at the Champaign convention a proposition, emanating from the former executive committee, to hold the convention for 1891 in this city the present month was discussed, and developed decided opposition, and although no action was reached, it was apparent that the objections were shared in by many of the delegates then present. A declaration on the subject was prevented by the courteous reference of the whole matter to this committee.

It is therefore due to the persons now present and to those who hope to attend this year's convention but are unable to be here at this time, and to the members of the executive committee, individually and collectively, to declare that until some time after the Champaign convention there was no thought of holding the convention of 1891 before the middle of November, or of locating it in Washington. Subsequent events presented the subject to the committee in such form that the whole question was discussed anew, with a view to the best interests of the Association. The consideration of the subject by the committee began in April and was carried on most earnestly and conscientiously for over 2 months, resulting in a a practically unanimous decision, as announced on July 1. This prevented designating the two sections to "present in general sessions of the convention a portion of the subjects coming before them" and the "general notice" of this selection 3 months in advance, as the early date finally selected for the convention had not been contemplated. The committee therefore gave this notice at the time of the first general announcement regarding this convention, which was fully 6 weeks ago. This whole subject has caused the committee so much anxiety that a full statement was deemed desirable; and it may properly be added that in the decision reached nearly every member of the committee acted at variance with his personal preferences as to either time or place, or both, and exercised his judgment as to his duty in the premises.

By law of Congress annual reports are now required from nearly all the institutions at any time participating in the Association, and a general interchange is made of these reports. The time of the convention is fully occupied, and the annual record is already a substantial pamphlet, making its publication a serious matter. It is therefore recommended that the provision of the constitution of this Association be repealed which requires a "brief report of the work and progress" of every institution represented at every convention to be presented, and time provided for such reports in the regular order of business. It might also be well to assign to a committee the duty of scrutinizing the constitution as a whole, with a view to removing some uncertainties which have resulted from repeated amendments.

The committee formally submits to the convention the program prepared for this meeting and asks its confirmation, with the hope that few changes will be found necessary. It also recommends the adoption of the rules of order which have governed former conventions of this Association, and that this committee be authorized, as heretofore, to receive all credentials and prepare the official roll of delegates.

Respectfully submitted, for the executive committee,

HENRY E. ALVORD,
Chairman.

The report of the executive committee was adopted.

The President called for the report of the chairman of the section on agriculture, the Treasurer, whose report was in order, being temporarily absent from the room.

Mr. Morrow stated that Mr. Plumb, chairman of the section on agriculture, was also absent.

Mr. Halsted, chairman of the section on botany, presented the following report:

REPORT OF THE SECTION ON BOTANY.

The present season is one of unusual activity among the station botanists. While several stations have newly been established and botanists appointed, thus enlarging the corps and its field of labors, it is to the older stations that we must look for present substantial results. Three weeks ago, as soon as it was learned that this Association would hold an August meeting, a letter was sent to each of the station botanists asking for the leading facts, in brief, that had been determined during the past 12 months. From the responses made, in the midst of a season's work, this report of progress is condensed within the limit assigned. It has seemed best, at the risk of repeating the subject matter, to touch briefly upon the leading results obtained by the several workers, and in the alphabetical order of their names.

Alwood of Virginia has demonstrated an effective treatment for a leaf blight of the apple and established the fact that weak Bordeaux mixtures are as effective for grape rot as stronger ones. He has been successful in the artificial pollination of wheat.

Arthur of Indiana has shown that in soaking wheat to kill smut spores the water can be heated to a considerably higher temperature than heretofore thought safe, and that this treatment while effective in destroying the smut spores, largely increases the yield of the grain. He has shown that the copper-sulphate method is effective with oats, but detrimental to the yield, and that the hot-water method is equally effective. Results in the method of preparing seed potatoes have been obtained that may materially modify the customary ways of planting.

Atkinson of Alabama has considered the fungous diseases of cotton, describing some new species, and recommending methods of treatment. He finds *Colletotrichum gossypii*, South., on leaves and stems, as well as on the bolls; notes great injury to the fig by *Uredo fici*, and gives suggestions as to spraying the trees to prevent it;

and records for the first time in the United States *Cercospora bolleana* on leaves of the fig. He describes the nature of "Frenching" in cotton and shows that it is due to a fungus, a species of *Fusarium*. Critical notes have been published upon *Erysipheæ* of the Carolinas and Alabama, including the new species *Microsphæra calocladophera* on *Quercus aquatica*.

Beal of Michigan continues his experiments on grasses and clovers planned several years ago.

Bessey of Nebraska has investigated the natural forestry of the State and will soon publish the results. He is continuing his study of the forage problem of the plains.

Burrill of Illinois has ascertained practical methods of exterminating Canada thistles. These pests do not seed in the rich prairie soil, but spread by rootstocks. Excellent results have been obtained with the copper compounds, as fungicides for grape rot, apple scab, and potato blight. The latter is demonstrated to be a bacterial disease. A serious trouble of the blackberry and raspberry has been traced to the twig blight of pears (*Micrococcus amylovorus*). Studies are in progress upon several other bacterial diseases. *Puccinia rubigo-vera* has been found living over winter in leaves of wheat and producing rust spores, which grow upon fresh foliage in early spring.

Chester of Delaware while confining himself almost exclusively to treatment of fungous diseases, has, in connection with the chemist, reached important conclusions as to the preparation of fungicides, for example, the use of carbonate of ammonia instead of aqua ammonia, the employment of glue, and the use of a double hypophosphite. It is now too early to report upon the many field experiments. A study has been made of leaf spot of alfalfa, wheat scab, and rot of scarlet clover.

Crandall of Colorado is making a botanical survey of the State and is engaged upon forage problems.

Detmers of Ohio is studying the life history of anthracnose of the blackberry and raspberry, apple scab, and potato blight, and the value of various fungicides. A State herbarium is being made.

Dudley of New York (Cornell) has found that the clover rust, prevalent from New England to the Sierras, is chiefly propagated in the uredo form, and is carried over the winter as mycelium. It was demonstrated that æcidiospores produce uredo spots and therefore the *Æcidium* of *Trifolium repens* and *Uromyces trifolii* are stages of the same species. The rust spores germinate best at a low temperature. As the second crop is most frequently infested and as this is a valuable fertilizer it may often be well to plow it under. The ordinary spores of the quince blight (*Entomosporium maculatum*) winter on the fallen leaves, not on the twigs, and germinating in early spring infect the host directly. Therefore all leaves should be burned in autumn.

Garman of Kentucky shows that Bordeaux mixture and eau céleste will check the strawberry blight. Salt and lime may be used to prevent the growth of the broom rape but will injure the host plant. Bluestone is satisfactory except for its expensiveness. Hot water may be used to kill the broom rape seed and is beneficial rather than injurious to hemp seed. Broom rape seed will retain its vitality in the soil for at least 2 years. Anthracnose of the grape can be controlled by using 6½ pounds of bluestone and 3½ pounds of lime to 22 gallons of water.

Harvey of Maine in his tests of germination of seeds, finds that a solution of corrosive sublimate, of a proper strength to destroy the germs of mold, will not injure the vitality of the treated seed. Fungicides and weeds are receiving attention.

Humphrey of Massachusetts has found the true pycnidial form of the black knot fungus; has identified the damping-off fungus with that causing the same trouble in Europe; and has added new facts concerning the scab of potato, the hibernation of cherry rot (*Monilia fructigena*), and the Peronosporæ of cucurbits.

Jones of Vermont during this his first year is experimenting with fungicides upon potato rot, apple scab and rust, and oat and corn smut, but it is now too early to report results.

Lamson of New Hampshire writes that his work in the station for the year consists in collecting grasses, weeds, and weed seeds, and making beginnings in mycology and bacteriology.

McCarthy of North Carolina besides preparing a hundred-page bulletin upon best agricultural grasses, has given much attention to field experiments with fungicides. The Burgundy mixture with soap is superior to the Bordeaux, and the latter is improved by adding a small amount of glue. Seed testing is continued in coöperation with other stations.

Mell of Alabama has made a microscopic study of the cotton plant and is endeavoring to improve its fiber and seed by crossing. The effect upon lumber of tapping for resin is being investigated. Wild grasses for grazing purposes, and weeds are receiving attention.

Pammel of Iowa during this his first year with the station has published considerable information upon fungous diseases of Iowa forage plants, including an illustrated paper of some length in a recent bulletin upon the treatment of these troubles, especially in the orchard and garden.

Scribner of Tennessee has a report upon the grasses of the State nearly ready for the press. The work upon fungous diseases is being continued.

Thaxter of Connecticut, we regret to note, has retired from distinctively station work, after doing excellent service in economic mycology. The results of his study of onion smut, potato scab, apple rust, and other fungous enemies, and means of combating them will be of permanent value.

Tracy of Mississippi is investigating the tomato blight, so destructive in his State, and preparing a flora of Mississippi.

A few have not responded. Of these Kellerman of Kansas is doubtless busy moving to Ohio, but his works upon smuts and breeding of corn will remain as fine examples of his many important investigations beyond the Missouri. Buckhout of Pennsylvania and some others have full loads of college work. Bolley of North Dakota and Wooton of New Mexico are new to their respective fields.

B. D. HALSTED,
Chairman.

The report was accepted.

Mr. WILLITS. Mr. Wilber, the representative of the Associated Press, is here this morning and wishes to obtain for general publication abstracts of our proceedings, addresses, and papers. I have just heard in part the report read by Mr. Halsted, and have told Mr. Wilber that I should like to have an abstract of that paper sent out, as it indicates in a large measure the general field of experiment covered. The Associated Press will deal generously with all the associations in convention here at this time, and will receive and telegraph as much as a column and a half a day if desired. In my judgment a committee should be appointed to furnish abstracts of all important papers and discussions to the Associated Press. If the substance of Mr. Halsted's paper can be delivered to-night at Room 72, Corcoran Building, it will be generously appreciated.

The SECRETARY. Mr. Halsted tells me that he will make an abstract of his paper this afternoon.

Mr. MYERS. I move that a committee of three be appointed to take charge of the work of preparing these abstracts for the Associated Press.

Mr. ALWOOD. I would like to suggest that if we can get each man who presents a paper to prepare an abstract of it himself the work will perhaps be done more intelligently than it could be by a committee of which the author is not a member.

Mr. MYERS. The object of the motion is to have some central point to which these papers can come to be abstracted. A few moments ago, at the suggestion of Mr. Willits, I had a consultation with the representative of the Associated Press, who suggested that this would be a most excellent way of accomplishing the work. They are very anxious to get full reports, and I agree with Secretary Willits in thinking that these should be furnished by our Association.

The motion was carried.

Mr. WILLITS. We will send from the Department of Agriculture a stenographer and typewriter to assist you in this work, and will facilitate it in every way possible. Of course it would be well to let each individual who has a paper make the abstract himself under the direction of the committee, which should simply act as the central authority, representing the Associated Press.

The PRESIDENT. How shall the committee be appointed?

Mr. MYERS. By the Chair.

The PRESIDENT. The Chair will appoint the committee later on (see p. 24).

We will now listen to the report of the Secretary and Treasurer.

The Secretary and Treasurer, Mr. Scovell, submitted his report.

The PRESIDENT. I think it has been usual to refer the report of the Treasurer to an auditing committee.

Mr. FREAR. I move that the report just read be received and referred to an auditing committee of three, to be appointed by the Chair.

The motion was carried.

Mr. ARMSBY. Knowing something of the difficulty of making these collections, it seems to me appropriate that we should return some acknowledgment to our Treasurer for his efficiency in the matter. I move that a vote of thanks be extended to Mr. Scovell for his very efficient services as treasurer.

The motion was carried.

The PRESIDENT. I will appoint on the auditing committee Messrs. Tracy of Mississippi, Phelps of Connecticut, and Smith of Minnesota.

We will now hear the report of the section on chemistry.

Mr. Neale, chairman of the section, presented the following report:

REPORT OF THE SECTION ON CHEMISTRY.

On the first of July a circular letter was addressed to each station asking for a brief synopsis of the chemical work which had been either attempted or completed since the last annual meeting of this Association. The replies indicate that forty-five different subjects have been considered. For present purposes each of these subjects may be brought under some one of the following general classes:

1. Detective duty.
2. Agricultural manufactories.

3. Work of immediate value in directing farm management.
4. Development of analytical methods and invention of apparatus.
5. Investigations of interest chiefly to students and scientists.

1. *Detective duty.*—Under detective duty the aim has been to classify lines of work which are carried out by chemists for the protection of the farmer, that is for his protection against fraudulent practices in the business world. The following may be cited as specific examples:

(1) The chemical analyses of fertilizers, condition powders, and similar secret preparations.

(2) The examination of fodders and feeds.

(3) The detection of adulterations in dairy products.

(4) Attempts to grade wheat at elevators by methods less objectionable than those now in ordinary use.

Thirteen stations report that the control of the fertilizer interest has been placed in the hands of their chemists. It is known that in very many instances the expenses of such work are paid from State treasuries, and this subject, therefore, would not properly come before this Association were it not that it covers a disputed field in some sections of the country.

In one case at least, in order to withstand pressure exercised by a powerful interest, it was necessary to secure an opinion from the office of the Secretary of Agriculture. This opinion indicates that the expenditure of the national fund in the support of a fertilizer control already established under State management, is contrary to the spirit of the Hatch act.

Thirteen stations also report that attention is devoted to analyses of feeding stuffs. A method for establishing a control system similar in all respects to that already established for the fertilizer trade was published 2 years ago by one laboratory. Present indications point to an increased interest in this question. One director, in replying to the circular letter of inquiry, expressed his conviction that the need of such a control in his State is now urgent.

Sixteen stations have devoted time to analyses of butter and other dairy products. In many instances this work has been done with higher aims, but in some cases the chemist has simply acted the necessary but disagreeable part of the expert witness in detecting fraudulent adulterations.

Only one American station reports that attention has been given to the question of establishing better standards for grading wheat. This question is not an easy one; it has busied one of the most active thinkers in Europe for 12 years past, and has led by slow stages up to the development in his laboratory of a complete flouring mill, capable of turning out, on a quantitative scale, all of the products from small samples—say 20 pounds—of wheat. Connected with it is a bake oven, in charge of trained chemists who have learned the baker's art by practical experience.

This miniature flouring mill and bakery have demonstrated that the laboratory tests used in grading wheat are not true guides to the value of the flour for bread making. Good milling varieties still have precedence over extremely productive varieties, a fact which the farmer must regard in selecting his seed if he would escape the penalty when the grain reaches the market.

2. *Agricultural manufactories.*—This class includes those lines of work in which machinery or appliances are used in reducing crude agricultural products to merchantable forms, the duty of the chemist being to determine the waste or deterioration in quality, due to imperfections in said machinery. It covers investigations made (1) in sugar houses, (2) in starch works, (3) in oil mills, (4) in wine cellars, (5) in creameries, (6) in fiber works, (7) in tannin extractors.

That a domestic sugar industry is regarded as extremely desirable is made evident by the generosity shown by Congress in appropriating money for investigations and arranging bounties for producers. That such an industry will be established in the near future may be foretold from the energy displayed North, South, East, and West in the study of the maple, the tropical cane, the sorghum, and the sugar beet.

The oil mills, the fiber and tannin works, the wine cellars, and the starch-washing plants are at present of local importance. Generally speaking, illustrations of each may be found in profitable operation somewhere in this country. Under such conditions the duty of the chemist who seeks to introduce such industries consists in securing available information, demonstrating its accuracy, familiarizing himself with details, and imparting his knowledge to those who can use it to pecuniary advantage.

3. *Work of immediate value in directing farm management.*—An underlying idea in this classification is that the question never appears to be definitely answered, no matter what degree of accuracy may have been attained by the experimenter. In this fact, possibly, lies the value of the tests; they are suggestive rather than positive. Illustrations are offered as follows:

(1) The chemical work involved in soil tests with commercial fertilizers, whether conducted on the plat plan or on the field scale.

(2) Feeding trials carried out as object lessons.

(3) Test of fodders and feeds regarded as new when considered locally.

(4) The ordinary analyses of plants at different stages of their growth.

(5) Chemical work connected with the trials of different breeds of milch cows.

(6) The ordinary soil and water analyses.

4. *Development of analytical methods and invention of apparatus.*—Each station devotes much time to tests of new, more accurate, or more rapid methods of analysis. Those interested in details are referred to the annual reports of the Association of Official Agricultural Chemists.

5. *Investigations of interest chiefly to students and scientists.*—Examples of this classification are—

(1) Experiments on the digestibility of fodders and feeds.

(2) The absorption of atmospheric nitrogen.

(3) The isolation of the protcids of maize, oat, and flaxseed.

(4) Studies of the heat of combustion of fats and carbohydrates.

While these subjects are of interest particularly to those who are busied with methods and reasons, it is also true that an intelligent and progressive class of farmers is rapidly growing in this country—farmers who are even now watching advances in theory and hastening to put conclusions to practical tests. The eagerness for information regarding leguminous plants, which has developed since the studies on the absorption of atmospheric nitrogen were renewed, serves as an illustration of that tendency. The space granted by our leading agricultural journals to inquiries concerning feeding standards and to replies thereto, serves as another indication of the spirit of the times.

It is evident from this summary that the ruling conditions in this country have turned the attention of chemists into relatively well-worn paths, which the purely chemical stations of continental Europe have been developing for a quarter of a century. Under proper management this work, with modifications, should soon be adapted to American wants, and then new paths must be opened.

American stations are built upon a broader foundation than are some of those in the older countries, and with increased resources come deeper responsibilities. For instance, the stations of Europe in the past afforded few opportunities for intercourse among botanists, entomologists, horticulturists, veterinarians, and chemists, and very few men working in one field were well informed as to the methods and results gained in other fields.

The staff of nearly every station in this country has a representative of each of the sciences, and unexcelled facilities therefore exist for coöperative investigations. If, for example, specialists in the study of animal nutrition feel that chemistry has been of very little assistance to them in untying their knotty problems, then the time has come for them to define their troubles sharply and ask for the attention which their field so well merits. If the botanist, busied in the field of plant pathology, finds that the products of fungous or bacterial life are factors either in causing

decay or in checking it after a certain stage has passed, he should be eager for a partnership with one trained in identifying chemical compounds and in studying chemical changes. If the student of animal pathology is confronted with mysterious troubles, he may do well to invite the mycologist or bacteriologist and the chemist to share his field. If the horticulturist wearies of present methods of comparing varieties, and seeks more definite reasons for observed differences in any given fruit or vegetable, it is not unreasonable to expect the chemist to furnish material assistance. This proposal was made years ago to the director of one of the leading German stations, but could not be accepted then simply because of lack of facilities for the work.

To conclude, much of the chemical work of the day fulfills the demands characteristic of new fields. As the stations age and as information among farmers becomes general the present marked tendency toward coöperative work will become more clearly defined, and the real value of the present organization of American stations will become evident.

A. T. Neale,
Chairman.

The report was accepted.

The President. The report from the section on entomology is postponed by request until next Monday. The report from the section on horticulture is in order. Who is chairman of that section?

Mr. Alwood. Professor Goff.

Mr. Henry. Professor Goff is not in attendance.

The President. The consideration of the report will be postponed. Next is the section on college work, of which Mr. Atherton is chairman. He is not present.

Are there any reports of committees? If not, the regular business assigned for this morning, namely, reports of committees and those of chairmen of sections, is completed.

Mr. Alwood. I would like to say that this Association at its general session at Champaign confirmed the selection of three members as a committee to attempt to secure standard sizes of connections and fittings for nozzles and pipe fixtures in spraying apparatus. I was appointed on that committee, with Mr. D. G. Fairchild of Washington, D. C., and Mr. Troop of Indiana. I have no formal report to make, but will state for general information that we have succeeded very well in interesting manufacturers in the matter. I think that by next year the best makers of insecticide machinery in this country will make the parts of their apparatus uniform in size and interchangeable. This is a very important point to some of the workers.

Mr. Alvord. I move that the executive committee be authorized to make up a roll of the delegates and others in attendance at this convention, and that for this purpose the members present hand in their names and the names of their institutions to the secretary of the Association, together with a statement as to whether they are here as delegates representing their respective colleges or stations. This should be done as soon as possible in order that we may proceed with the enrollment and have the list for use during the remainder of the day.

The motion was carried.

The PRESIDENT. Is the committee appointed to prepare a collective station exhibit for the World's Columbian Exposition ready to report?

Mr. HENRY. Dr. Armsby is rewriting some parts of his report. He will be prepared to report at the afternoon session.

The PRESIDENT. I will appoint as the committee to take charge of the matter of abstracting the various reports, etc., Messrs. Myers of West Virginia, Halsted of New Jersey, and Roberts of New York.

At 11:30 a. m. adjourned to 2 p. m.

AFTERNOON SESSION, WEDNESDAY, AUGUST 12, 1891.

The meeting was called to order by Vice President Roberts at 2:20 p. m.

The CHAIRMAN. President Goodell is detained at his hotel by illness, and I am informed that I am first vice president, or first on the list of the vice presidents present, and that consequently I am to assume the chair. I suppose that the real reason for putting me here is that I may be kept from talking too much on the floor, as I am likely to do.

As I understand, the reports of the sections on horticulture and entomology will not be called for this afternoon. Reports of committees are in order, and I believe that the chairman of the committee appointed to audit the report of the Treasurer is ready to report.

Mr. Tracy read the report referred to, as follows:

Your committee to which was referred the report of the Treasurer, has carefully examined his accounts and finds them correct. His receipts during the year have amounted to the sum of $1,716.52, and bills have been paid to the amount of $1,407.03, leaving a cash balance of $309.49 now in the hands of the Treasurer. For the amounts paid out vouchers are on file, all of which have been properly approved and receipted.

S. M. TRACY,
C. S. PHELPS,
C. D. SMITH,
Committee.

AUGUST 12, 1891.

The report was accepted.

Mr. ARMSBY. The committee on the exhibit at the World's Columbian Exposition is prepared to report at this time if it is desired.

The CHAIRMAN. I notice that the program calls for discussion of the questions involved in the reports presented. I suppose that if it is desired to bring up for discussion any of the matters that have gone before such discussion would be first in order. If there are no objections the report of the committee will be read.

Mr. Armsby, chairman of the committee, presented the following report:

REPORT OF THE COMMITTEE ON COÖPERATIVE STATION EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Your committee has held two meetings, a brief one immediately after its appointment and one April 8 and 9. A very considerable amount of work has also been done by correspondence between the several members of the committee and with the various stations.

The work of the committee has necessarily been chiefly of a preliminary character, and we are not able as yet to make a very specific or detailed report. We trust, however, that we have been able to so plan and organize the work of preparation that, especially after the personal consultations rendered possible by the present meeting, it will go forward rapidly and successfully.

The degree of interest in the project manifested by the stations in general has been very gratifying to the committee, as being the best assurance of the success of the undertaking. We feel confident from the tenor of our correspondence with the stations that the institutions represented in this Association appreciate the value of the opportunity afforded by the Exposition to bring their work before the public, and that they will subordinate all personal considerations to the success of the exhibit as a whole.

We desire also to take this opportunity of expressing our appreciation of the very cordial spirit which has been manifested by the U. S. Department of Agriculture, as represented by the Assistant Secretary and the Director and Assistant Director of the Office of Experiment Stations. In all our consultations with these gentlemen they have shown a most hearty and unselfish desire to promote the interests of the stations, and it is the hope of your committee that the coöperation which has been inaugurated in this matter will do much to foster that feeling of community of interest which should exist between these two agencies for the advancement of agriculture.

We likewise wish to acknowledge the interest which has been manifested in the proposed exhibit and the many courtesies accorded to us by the Exposition authorities, especially by Hon. Benjamin Butterworth, secretary of the Directory and of the Congress Auxiliary, and by Mr. W. I. Buchanan, superintendent of the agricultural department.

The resolutions under which we were appointed were quite general in their terms, and we have felt justified in assuming that it was the intention to leave considerable latitude for the exercise of our discretion. As will appear, subjects have presented themselves to us for consideration which were not specifically included in the resolutions appointing us, but which, in our judgment, were of such general interest and importance that we felt we should not justify the confidence so generously reposed in us by the Association if we declined to consider or act upon them. In all cases, however, we have aimed to avoid committing the Association to any line of action, leaving it free to adopt such a policy as it might deem best.

The coöperative exhibit.—The committee, as stated, held a brief meeting for consultation at Champaign immediately after its appointment. It being obvious that a definite and tolerably detailed plan for the exhibit was the first requisite, it was agreed that the chairman of the committee should, as soon as practicable, visit Washington for consultation with the U. S. Department of Agriculture. As a result of this consultation and of correspondence between the members of the committee, the following general scheme for the exhibit was prepared and distributed to the stations for their suggestions and criticisms. A copy of the plan, together with a circular letter sent out with it, is appended.

STATE COLLEGE, CENTER COUNTY, PENNSYLVANIA.

January 1, 1891.

DEAR SIR: At the recent convention of the Association of American Agricultural Colleges and Experiment Stations at Champaign, Illinois, the subject of a coöperative station exhibit in connection with that of the U. S. Department of Agriculture, at the World's Columbian Exposition, was brought forward, and a plan for such an exhibit was presented by Mr. A. W. Harris, Assistant Director of the Office of Experiment Stations. After considering the subject the convention adopted the following resolutions:

Resolved, That in the opinion of the Association it is advisable to have a coöperative station exhibit at the World's Columbian Exposition.

Resolved, That to formulate and carry out such preliminary steps as are necessary during the year a special committee, with power to represent the Association, be appointed by this convention to coöperate with the Department of Agriculture and to take such other action as may be necessary.

Resolved, That the executive committee be authorized to pay from the funds of the Association the actual and necessary expenses incurred by the above-named committee in the discharge of its duties.

In pursuance of these resolutions the following committee was appointed: H. P. Armsby of Pennsylvania, G. E. Morrow of Illinois, C. E. Thorne of Ohio, S. M. Tracy of Mississippi, and W. A. Henry of Wisconsin.

This committee, in coöperation with the Office of Experiment Stations of the Department of Agriculture, has further considered and elaborated the plan proposed, and it will shortly be submitted to the several stations for their consideration.

The time available for preparing such an exhibit is comparatively brief, and to insure that it shall adequately represent the work of the stations it is imperative that a definite plan should be agreed upon at as early a date as is consistent with a due consideration of all the interests involved. The committee therefore urgently requests you to inform it as promptly as possible after the receipt of the proposed plan—

(1) Whether your station will probably coöperate in such an exhibit.

(2) Of any modification of or additions to the proposed plan which you consider desirable.

(3) Of any specific contributions which your station can make, either to the exhibit of the individual stations or to the topical exhibit.

In formulating a final plan for the exhibit, it is desired to adapt it as far as possible to the circumstances and desires of all concerned. The committee hopes, therefore, that you and all those associated with you in the work of your station will not fail to give it the benefit of your counsel in a matter which so largely affects the common interest of all. It is hoped, too, that the very cordial attitude of the U. S. Department of Agriculture and its generous proposition (only contingent on the amount of funds available to defray a considerable share of the expense of the proposed exhibit) will meet with a general and hearty response.

In behalf of the committee,

Very respectfully yours,

H. P. Armsby,
Chairman.

Proposed plan for a coöperative station exhibit at the World's Columbian Exposition, prepared by the U. S. Department of Agriculture and the committee of the Association of American Agricultural Colleges and Experiment Stations.—In preparing this plan the following have been leading considerations:

(1) The Exposition will afford an exceptional opportunity to bring the work of the stations to the notice of the public, and one of which it is desirable to take the fullest possible advantage. The work of the stations covers a wide range of subjects related to scientific and practical agriculture, and thus includes many things which are intimately connected with the life and work of a very large proportion of the people of the country. At the same time it is so clearly distinguished from that of the practical agriculturist that their exhibit would be very different from that of agriculture in general. Dealing with subjects of common interest and in ways which are new to most of our people, the stations will be able to make an exhibit which will be very attractive, highly educational in its influences, and decidedly beneficial to the stations themselves. By its means the people will be enabled to get some idea of the importance and value of this great scientific enterprise in behalf of agriculture, and will thus be led to give the most hearty support to the work which these institutions are carrying on.

(2) In order to adequately represent the work of the experiment stations of the United States as a whole, a coöperative exhibit by the stations generally, upon a

uniform plan, is indispensable. While separate exhibits, which will doubtless be made by stations in connection with the various State exhibits, will most fully represent the work of the individual stations, only a collective exhibit will impress upon visitors the scope and magnitude of the experiment station enterprise or render it practicable for the student to grasp its bearings on scientific, agricultural, and social questions.

(3) The object of such a collective exhibit should be to illustrate the work of the experiment stations as a whole, rather than to make a complete showing of that of individual stations. Consequently the exhibit should be largely topical in character, but with provision for showing the main features of the work of each station. Each contribution should be distinctly credited to the station sending it, and visitors should be referred by labels and otherwise to any separate exhibit of the station in connection with its State exhibit or that of the educational institution to which it is attached.

(4) The plan should take account of the fact that the stations derive the larger part of their support from the U. S. Treasury. For this reason it seems eminently proper that the collective exhibit of the stations should find a place in the Government building.

(5) The stations, through the Office of Experiment Stations, have definite relations with the U. S. Department of Agriculture, while yet distinct from it in organization and work. An exhibit of the stations in the Government building should therefore be made in connection with that of the Department of Agriculture, but distinguished from it by being in a separate room or rooms, and should include an exhibit by the Office of Experiment Stations. The U. S. Department of Agriculture has included the experiment station exhibit in its estimates for floor space. It also hopes to be able to defray the expenses of the transportation, installation, care and custody, and return of the exhibits, leaving to the stations only the expense of preparing their own contributions, which would remain their property and be largely available for museum and other purposes.

The following is an outline of the plan which is proposed and regarding which suggestions are desired:

A. *The material exhibit.*

To be located in the Government building in connection with the exhibit of the Department of Agriculture, but in separate rooms. To consist of—

(1) An experiment station in operation (to be manned by station workers).

(*a*) The indoor departments (space 80 by 20 feet).

Office: Methods of keeping records, accounts, labor blanks, mailing lists, and of mailing publications, etc.

Library: A select library of technical books; files of scientific and agricultural journals; files of station publications; methods of cataloguing, etc.

Chemical laboratory: General arrangement and construction; special apparatus and methods of chemical investigation; fertilizer, fodder, and milk analysis in progress; chemical and physical investigations of soils.

Botanical laboratory: General arrangement and construction; apparatus and methods of investigation; herbarium; seed testing; mycology; bacteriology.

Entomological laboratory: Arrangement and construction; apparatus and methods; collections; insecticides.

(*b*) The outdoor departments (in so far as feasible).

Greenhouse: Methods of construction and heating; cross-fertilization; water and sand cultures; varieties; grass garden, on small scale; fungicides; insecticides.

Stable: Digestion experiments with sheep; feeding for milk, beef, etc.

Dairy: Milk testing; different processes of chemical control; fermentations of milk; methods of creaming, etc.

Apiary.

(2) An exhibit of the work of the stations. (To occupy a room about 80 by 80

feet, divided into a broad central passage and ten alcoves—five on each side. A large index map of the United States to be suspended near one end of this passage, showing geographical and regional location of each station, etc. Near the other end of the passage a collection of the agriculturally important chemical elements and compounds.)

(*a*) The work of the individual stations. (To occupy the central passage. The exhibits of the individual stations should include statement of geographical location, altitude, hydrographic and climatological relations; pictures, plans, maps, models, etc., showing buildings and equipment; a complete set of publications; chart showing history, relation to other institutions, financial resources, etc.; and an exhibit illustrating the principal lines of work. Here should be located also the special exhibit of the Office of Experiment Stations.)

(*b*) Topical exhibit of the work of the stations. (To occupy the ten alcoves, each alcove to illustrate methods, apparatus, and results pertaining to a special subject or class of subjects; whatever any individual station contributes to be labeled so as to give due credit to that station; reference to be made by labels or otherwise to the operations in progress in the model station, illustrating the subject to which the alcove is devoted, and to exhibits of individual stations in State exhibits.)

The following is proposed as a tentative classification of these alcoves:

Alcoves 1–5, plant production.

Alcove 1, soils:

Origin and formation: Minerals and rocks from which soils are formed; weathering; influence of vegetation.

Physical properties: Specimens of typical soils; state of division; mechanical soil analysis; relations to water, heat, and gases.

Chemical properties: Composition; chemical actions in the soil; the soil as a source of plant food; soil absorption; soil analysis * and its significance.

Microörganisms of the soil: Nitrification and denitrification.

Alcove 2, manuring:

Manures and fertilizers: Yard manure; composition; relations to feed; preservation and handling; barnyards.

Commercial fertilizers: Specimens of fertilizers and their raw materials; methods of manufacture; statistics of fertilizer trade; fertilizer control.

Agricultural value of manure: Field, pot, and box experiments; † drainage and irrigation.

Statistics of manuring: Gains and losses of fertility by the soil; relations of stock feeding and of grain growing to fertility.

Adaptation of manure to crop: Feeding capacities of crops; rotations; pot experiments.†

Alcove 3, crops:

Germination and seed testing: Chemical and morphological processes in germination; influence of heat, light, moisture, etc.; apparatus and methods for seed testing;‡ specimens of good and poor seeds; effects of frost and of diseases; effect of age; seed adulterations; harmless and dangerous adulterations.

Assimilation: Essential and nonessential elements; water cultures;† source of each ingredient and manner of assimilation; nitrogen supply of plants; carbon supply of plants.

Metabolism: Respiration of plants.

Characteristics of different crops: Variety testing;† synonymy; production and improvement of varieties;† methods of planting, cultivation, and harvesting.

Alcove 4, horticulture:

Production and improvement of varieties:† Effects of fertilizers on fruits and vegetables; methods of grafting and budding.†

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* Reference to chemical laboratory.

† Reference to greenhouse.

‡ Reference to botanical laboratory of model station.

Imported varieties:* Tests of varieties for originators.

Alcove 5, botany, mycology, plant diseases, fungicides, bacteriology:

Collections of native grasses, the rarer forage plants, etc.; collections of weeds classified according to their injurious qualities on some such plan as that suggested by the New Jersey Station; the development of the roots of different kinds of plants; the origin, development, and treatment of certain plant diseases; fungicides, methods of preparation and application.

Alcoves 6–10, animal production.

Alcove 6, animal nutrition:

The Animal: Anatomy, histology, components of body; specimens of chief proximate ingredients.

Composition: Chemical composition of live animals of different kinds; charts, tables, and proportionate weights of the ultimate and proximate constituents.

Digestion: Models of digestive organs of domestic animals; specimens of digestive fluids and ferments; illustrations of their actions on foods; digestion experiments† and appliances for them.

Excretion: Models of excretory organs; diagrammatic representation of manner of excretion of elements, especially nitrogen.

Respiration: Models of respiratory organs; difference between inspired and expired air; respiration apparatus (models or pictures).

Feeding: Maintenance rations; sources of flesh and fat; differences in nutrition of old and young animals; influence of food on composition of carcass; milk production; anatomy of milk glands; influence of food on quantity and quality of milk;† the food of working animals; feeding standards (figures and diagrams); oyster culture; poultry.

Alcove 7, feeding stuffs:

Samples of the less familiar fodders, especially of by-products of manufacturing operations showing sources and processes of manufacture, and of usual forage plants and native grasses.

Composition‡ and digestibility of feeding stuffs, illustrated by a collection of the chemical constituents of fodders in proper proportions.

Influence of various conditions on digestibility.

Fuel value of fodders; calorimetry.

Forage crops: Yield per acre of crude nutrients and digestible materials by various crops; effects of different methods of planting and cultivation and of time of harvesting on yield and quality; soiling and pasturage.

Preservation and preparation: Losses in hay making; silage; construction of silos, and machinery (models and drawings); samples of silage; chemical changes in the silo and their effect on composition and digestibility of silage; relative losses by drying and by ensiling; relative economy of the two processes; biology of silage.‡

Adulterations: Samples of pure and adulterated fodders and of adulterants; microscopic appearance of the same; methods for the detection of adulterants.‡

Alcove 8, dairying:

Milk: Composition† and variations in composition, illustrated as in case of fodders; influence of food,§ breed,§ period of lactation, and other factors on composition; preservation; adulteration; milk testing;‖ methods of handling milk.

Creaming: Efficiency of different methods;‖ influence of various conditions upon creaming.

Butter: Composition,† illustrated as in case of fodders and milk; variations in composition; composition of butter fat; theory of churning; influence of various

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* Reference to greenhouse.

† Reference to chemical laboratory.

‡ Reference to botanical laboratory of model station.

§ Reference to barn.

‖ Reference to dairy.

conditions upon churning; the butter extractor; quality of butter; influence of food, etc., upon quality; adulteration; detection of foreign fats.

Cheese: Composition illustrated; quality as affected by that of milk; rennet and its action on milk; influence of time, temperature, and quantity; ripening; adulterations and their detection.

Ferments and fermentations in the dairy: Bacteria in milk, cream, butter, and cheese.

Distribution of ingredients in butter and cheese making.

Alcove 9, veterinary science:

Models and preparations showing various diseases and accidents; instruments and methods of treatment; statistics of animal diseases.

Alcove 10, entomology:

Collection of selected insects to illustrate life history and means for repression.

Insects whose life history has been determined by station workers.

Insectcides: Methods of preparation and application.

Apiculture: Methods and processes.

In connection with the exhibit of the work of American stations it is believed to be very desirable to secure, as far as practicable, exhibits by foreign stations, and also a conference of experiment station workers from all countries. Both these things are in contemplation, but it has not yet been possible to make any definite arrangements.

B. *Explanation of exhibit.*

Labels.—A complete and carefully prepared system of labels will be essential.

Descriptive publications.—Small pamphlets, "primers," or "leaflets," explaining the exhibit as a whole and the several parts—one for each alcove—are contemplated. These would serve the visitor not only on the ground but also to take home for further use.

Personal explanations.—It is proposed that members of station staffs, students of the agricultural colleges, or others be detailed by the stations as workers in the model station and as demonstrators to explain to visitors the meaning of the exhibit. It is believed that the educational value of the exhibit and its efficiency in securing public appreciation of the stations will thus be greatly enhanced.

C. *Report of exhibit.*

Monograph on the experiment station enterprise.—The opportunity should be utilized for preparing a detailed report upon the exhibit, with illustrations, and in connection with it a monographic account of the experiment station enterprise, its history, workings, and achievements up to the time of the Exposition. This should serve as a handbook of reference for all interested in the progress of agriculture, an indication to the public of the value of the experiment station and the magnitude of the enterprise, and should also be the mark of an epoch in the history of the station movement and the lasting monument of the exhibit.

It is proper to say in regard to this proposed plan that the committee was well aware that it was impossible for a few individuals to formulate a plan which should be perfectly adapted to all the different conditions prevailing in the several stations. The plan as adopted was intended to be only tentative in its character, and subject to such changes as might be found necessary in the progress of the work. It was intended to be as complete a system of classification as possible, and consequently various subjects were included which it is very probable will not appear in the completed exhibit.

Responses to this letter and circular and to a later letter have been received from nearly all the stations, and in practically every case the committee was assured that the station would coöperate to the extent of its ability. At the same time it became

obvious from the very general nature of most of the replies that it would be necessary for our committee to take the initiative to a considerable extent in suggesting to the various stations particular lines of work which they might illustrate.

A meeting of the committee was therefore held in Chicago April 8 and 9, in consultation with Mr. A. W. Harris, representing the U. S. Department of Agriculture, for the purpose of making more specific plans as to the nature of the exhibit in its various departments. After full consultation it was decided to assign the preparation of the exhibit in each of the ten departments or alcoves proposed by the committee to a single specialist in that department, whose duty it should be to organize and bring together the various exhibits provided for. In order to secure as uniform a distribution of the work among all the stations as possible, the committee reserved to itself the final adjustment and arrangement. Some little time was consumed in correspondence with the various gentlemen selected to take charge of the different portions of the exhibit, but by the first of June the positions had all been filled satisfactorily, and the following circular letter was sent to all the experiment stations:

STATE COLLEGE, CENTER COUNTY, PENNSYLVANIA,
June 1, 1891.

DEAR SIR: This committee has received from nearly all the stations very encouraging replies to its circular letters regarding the proposed exhibit at the World's Columbian Exposition. The plan proposed by the committee has met with general acceptance, and the coöperation of all or nearly all the stations seems to be assured.

At a meeting of the committee held April 8 and 9 in Chicago, it was unanimously decided to proceed with the preparation of the exhibit on the plan proposed, with such modifications as to details as experience should prove to be desirable. In order to secure greater efficiency, especially in the preparation of the topical exhibit, it is proposed to put the preparation of the exhibit in each one of the ten alcoves in the hands of a single specialist in that subject. The following gentlemen have kindly consented to take charge of the preparation of the several departments of the exhibit:

Experiment station in operation, the Director of the Office of Experiment Stations.

The exhibits of the individual stations, H. P. Armsby of Pennsylvania.

Alcove 1, soils, E. W. Hilgard of California.

Alcove 2, manuring, C. E. Thorne of Ohio.

Alcove 3, crops, C. S. Plumb of Indiana.

Alcove 4, horticulture, E. A. Popenoe of Kansas.

Alcove 5, botany, S. M. Tracy of Mississippi.

Alcove 6, animal nutrition, W. H. Jordan of Maine.

Alcove 7, feeding stuffs, W. A. Henry of Wisconsin.

Alcove 8, dairying, W. W. Cooke of Vermont.

Alcove 9, veterinary science, P. Paquin of Missouri.

Alcove 10, entomology, S. A. Forbes of Illinois.

It is the hope of the committee, as well as of these gentlemen individually, that they will receive the fullest and most cordial coöperation of all interested, and that every experiment station worker will consider himself a committee of one on the exhibit in his special field, and will communicate promptly and freely any suggestions or criticisms calculated to further the success of the exhibit. The opportunity afforded by the Exposition to acquaint the general public with the scope and aims of experiment station work is unique and only needs to be improved, as it easily can be by united effort, to result in great good to the stations.

H. P. ARMSBY,
Chairman.

Your committee is not able to present at this time any specific report as to the progress made in the various departments. In some, considerable work has been

done, while from others no report has as yet been received by the committee. In several cases the formulating of definite plans has been delayed for the purpose of personal consultation at the present convention.

CONFERENCES OF EXPERIMENT STATION WORKERS.

One of the things named in the circular issued by this committee as desirable was a conference of experiment station workers from all countries, in connection with the material exhibit of the work of the stations. Under the direction of the World's Congress Auxiliary of the Exposition arrangements are being made for a series of congresses or conferences designed to bring together, from all civilized lands, representative men interested in the leading lines of the world's thought and work. This organization has tendered honorary membership to officers of a number of the colleges and stations comprising this Association and has made some of those residing near Chicago members of its special committees, including Prof. G. E. Morrow of this committee as one of its committee on an Agricultural Congress.

At the April meeting of this committee, therefore, Prof. G. E. Morrow and President H. H. Goodell were appointed a subcommittee to confer with the Congress Auxiliary.

Frequent informal conferences with the officers of the Congress Auxiliary have shown that they are taking a most gratifying interest in the proposed Agricultural Congress. Its special committee has issued a preliminary address, in which, among other topics named for discussion by the Congress, agricultural education and agricultural investigation and experimentation are given a prominent place. It is confidently believed that, in regard to these subjects especially, any suggestions from this Association will have a controlling influence.

Organized with the approval and indorsement of the Exposition Directory, which will give it financial aid and provide audience rooms for the meetings held under its general direction, it is believed the Congress Auxiliary will be able to accomplish much and that it is advisable to maintain close relations with it.

COÖPERATION WITH THE COLUMBIAN DAIRY ASSOCIATION.

The plan for the exhibit formulated by your committee contemplated among other things a model station, including the outdoor departments so far as feasible. Subsequent developments, however, showed that very little if anything could probably be done in this line in direct connection with the exhibit in the Government building.

By this time the plans of the Columbian Dairy Association for a working dairy and for tests of dairy breeds began to be discussed in the agricultural press, and it was thought that possibly part of what it was desired to show of the outdoor operations of a station could be accomplished by coöperation with that association.

At the meeting of the committee in April, Mr. John Boyd of Chicago, representing the Columbian Dairy Association, appeared before the committee and informally proposed a coöperation between the associated experiment stations and his association in the conduct of the working dairy and in the proposed tests of breeds of dairy cattle during the Exposition. From our conversation with Mr. Boyd it appeared that it was hardly practicable to arrange any method by which such coöperation could be made to illustrate to any considerable extent the *outdoor* work of a station, although the necessary *laboratory* work might be carried on in connection with the proposed model station. The subject was thus in part placed outside the jurisdiction of our committee under a strict construction of the resolutions appointing it, although still having an important relation to one part of the proposed exhibit. The matter appeared of so much importance to us, however, and the desirability of coöperation with the Columbian Dairy Association, under proper conditions, so manifest, that we felt that the Association would sustain us in following up the subject.

A special subcommittee of three, consisting of the chairman of the committee, Prof. W. A. Henry, and Prof. W. W. Cooke, was therefore appointed to confer with the Columbian Dairy Association or its representatives, and the secretary of that association was notified of the action. That subcommittee attended the recent meeting of the Columbian Dairy Association, representatives of the various breeders' associations, and of the Dairy Implement Manufacturers, held at Chicago, July 29, and met with a very cordial reception. There was evident at this meeting a feeling of confidence in the stations and a recognition of the weight which their coöperation and indorsement would give to the results of the proposed tests. This was apparent in the discussions, and took concrete form in the resolutions which were adopted requesting this Association to appoint a representative on the committee to supervise the tests and three representatives on the committee to formulate rules for the tests.

With the presentation of these requests to the Association through its executive committee the connection of our committee with the matter is brought to an end. We desire to say, however, that while we have taken pains to have it distinctly understood that we had no authority to make any promises on behalf of the Association, and while the convention can therefore take whatever course it may deem wise entirely unembarrassed by the action of our committee, we deem it exceedingly desirable that a cordial response should be made to the overtures of the Columbian Dairy Association. We believe the tests are likely to be carried out on a scale and in a manner calculated to yield results of great value. Far more important, however, than the actual results obtained by this coöperation will be its value as a precedent. If the stations are thus recognized as indispensable adjuncts in these important tests, it will do more than any other one thing to establish their standing with the agricultural public. In our judgment, the thing is well worth the expenditure of even considerable time and money.

In conclusion we may add that we think the matter of the analytical work involved can be cared for without serious difficulty as a part of the proposed coöperative exhibit, serving to illustrate some of the simpler laboratory operations of an experiment station.

Very respectfully submitted.

H. P. Armsby,
Chairman of the Committee.

Mr. Alvord. I move that the report be accepted, understanding it to be a report of progress. Without recalling the exact phraseology of the motion or act of the convention creating this committee, I have no doubt that it was understood to be virtually a standing committee while this question as to the Exposition should remain pending; and as this committee is one eminently representative of our body and has the matter well in hand, I think that question should now be settled. I propose, therefore, if the first motion is agreed to—to adopt this report as a report of progress—to follow it with a motion for the continuance of this committee as a standing committee of the Association until the close of the World's Columbian Exposition. Having thus entered upon the work and placed it in proper hands, it seems to me that it should remain in the same hands until completed.

Mr. Morrow. As a member of that committee I trust it will be distinctly understood that there is no possible connection between the motion that Mr. Alvord offers and the one which he proposes to offer. While it seems to me that it would be very proper to continue the committee, I do not wish that any one should have his judgment as to

whether this report ought to be adopted influenced by Major Alvord's second proposition. That seems to me altogether another question.

The motion to adopt the report was seconded.

The CHAIRMAN. The paper is now properly before you for discussion. It covers a very wide field, and unless it is to be brought up later I should dislike to see it buried at the present time without some careful discussion. The field of work here mapped out is a broad one, and what is done will affect others as well as ourselves. We must consider carefully not only the effect upon our own nation, but also the effect on foreign nations. They will come here expecting to see some of our agricultural experiment stations and colleges and their work, and to see them well represented at Chicago; and now, it appears to me, is the time to discuss the details of this report.

Mr. JENKINS. I am particularly interested in that part of the report which bears on the proposed agricultural congresses, composed of representative agriculturists, in connection with the Exposition, and if it is in order I wish that the chairman of the committee would give us a little further information with regard to the plan proposed in relation to these congresses.

Mr. ARMSBY. The member of the committee who has been specially charged with this aspect of the work is Professor Morrow, who has had exceptional facilities for gaining knowledge of the requirements, from the fact that he is also, as was stated in the report, a member of the committee on agricultural congresses of the Congress Auxiliary, and I may say here—I think the fact is recognized—that he will be very potent in determining the action of that committee. I suggest that Professor Morrow be heard on this subject.

Mr. MORROW. A number of those present will recall an entirely informal but very interesting interview that was held in Chicago, after the close of the Champaign meeting, with President Bonney of the Congress Auxiliary, Vice President Bryan of the Exposition Directory and Congress Auxiliary, and Secretary Butterworth, in which this matter, so far as it was then developed, was discussed. Although I may assume that most of you, if not all, have a general idea as to what we are doing, a brief statement may not be out of place. The organization has adopted what seems to me the happy motto, "Not things, but men," and is composed almost exclusively of men living in Chicago or its immediate vicinity. This is true of the officers with the exception of President Bonney, a most able and enthusiastic man, who is giving very much attention to it. The intention is to have a series of what it has been decided to call congresses, to continue during most of the time during the 6 months of the Exposition, each of them to be allowed from 1 to 2 weeks time. These congresses will deal with general educational and distinctively scientific problems, and with the great labor, social, and religious questions of the day. I say this simply to indicate generally the scope of the work to be instituted and carried on in these

congresses. What we are more immediately interested in is a series of agricultural meetings, for which the month of October has been suggested as the most favorable time. The Exposition Directory is taking, as it seems to me, a broad view in regard to the value of these meetings, believing that by pursuing a sagacious business policy they may be made effective in largely increasing the attendance at the Exposition. They will assume the responsibility for a large expenditure in securing audience rooms for all the meetings, possibly engaging even the great auditorium.

It is not intended that the Auxiliary shall take complete control of any meeting unless that shall be desired. The design is that it shall be helpful rather than controlling. The plan is to appoint small committees specially charged with the duty of caring for the interests of the several congresses, and in accordance with this design Mr. Butterworth, so widely known in many lines, and one of the most active officials in any way connected with the Exposition, has accepted the chairmanship of the agricultural committee. As has been so kindly stated by the chairman of the committee, whose report is before you, I have been honored with a place on the agricultural committee, and being intimately acquainted with Mr. Butterworth, and somewhat intimately with President Bonney, my relations have been quite happy, and I may say, personally rather than officially, that I have been delighted with the cordiality with which this Association has been recognized, and I am absolutely confident that it can mold and shape that Agricultural Congress, on both the lines of work that it represents, exactly as in its judgment seems best. Not to prolong this talk, I may state that as yet but little has been done. I have here a number of copies of the preliminary report made by the committee on agricultural congresses, which will afford an outline of the work thus far accomplished. There will be subcommittees on agricultural education, agricultural experimentation, etc., and while I do not speak officially, I am nevertheless authorized to say that this Association will have the selection of the committee, and will thus largely control and direct it. Judging from my own knowledge and that of others interested, I believe that the congresses will be placed on a high plane, and that it will be in every way desirable for us to lend the most hearty personal aid to them, and as an association to maintain as close relations with them as is practicable. For myself I may say that as a member of the Agricultural Congress committee, I shall be most happy to transmit to its chairman and to the auxiliary committee any provisions you may wish to make for the promotion of any action taken by this Association.

Mr. WILLITS. Let me ask Professor Morrow a question. Are these congresses to be international or national?

Mr. MORROW. I thank Mr. Willits for calling my attention to the point. They are to be international.

Mr. WILLITS. Who issues the invitations?

Mr. MORROW. The invitations will be issued in the name of this Congress Auxiliary, which is indorsed really and directly by Congress, and thus is believed to be a fitting medium to issue the invitations as the official announcement of the Exposition Directory. And this leads me to what I had intended to say. It was found necessary to abandon the original plan of inviting to honorary membership in the Congress Auxiliary all those whose aid was desired, it being found that their number was so very large that the honor conferred would be meaningless and valueless. The present purpose as to foreign nations is to secure, so far as possible, in European and other countries, sectional organizations representing the particular interests in question as to their own lands.

Mr. WILLITS. My idea more particularly stated is this: In the Department of Agriculture we are very much embarrassed over that very question, since we have already two delegates from the Department in attendance at international conventions. We were invited by the foreign governments to send them. Dr. Salmon is already in London, and Dr. Smart, our former president, is to go to The Hague. To-day two delegates from the Weather Bureau, Professors Harrington and Abbe, start for Europe to attend the International Meteorological Congress in Munich on the twenty-fifth of this month. They go laden with the hope that we may have the International Meteorological Congress in America in 1893, but we dare not ask for it; we have no authority, although of course we wish to reciprocate. The foreign governments not only invite us, but pay all expenses and appropriate money for excursions and all that sort of thing; but we do not know how to move in the matter. We had thought—and this is just the question—that possibly the World's Columbian Exposition might have sufficient scope, under the authority given it by the Government, to assume a national character and issue these invitations. In Europe everything of this kind is done by government machinery, and what we do in this line here should not have the appearance of a side show. Our plans are not yet fully formulated, and that is why I ask how it is proposed to issue the invitations. While, as I have said, Professors Harrington and Abbe hope that we may have the International Meteorological Congress in connection with the Exposition in 1893, we do not know just how to go about securing it, and I trusted that you could tell me something as to that.

Mr. MORROW. I am glad that Mr. Willits has called attention to this matter. It has been my own hope that the Department of Agriculture or the Government in some way would be able to issue these invitations, but up to this time it has been apparent, from the financial standpoint, that this could not be done. So far as it can consistently, this organization, which will officially represent the Exposition in these matters, will issue the invitations. I do not feel authorized to say that any expenditures beyond defraying the expenses of the congresses while

here can be met by us; that is, I do not feel that the Congress Auxiliary is at present authorized to do anything in the way of extending personal courtesies to representatives of other associations and governments, but the Directory, which has, as I understand, formally assumed charge of the meetings, will secure the audience rooms and look after all such matters as printing and that sort of thing.

Mr. WILLITS. The printing is just what I want to know about—not the printing of the advertisements, but of the proceedings; will they print the proceedings? Gentlemen will come here prepared with long reports on certain assigned subjects, and the proceedings of that congress in October will make a volume of 800 pages at least. Now who is to print that?

Mr. MORROW. I am glad that Mr. Willits has brought up that question, for it carries us a step forward, and I am, if you will allow me to use the phrase, in one way a sort of go-between—in no bad sense, I trust. I wish to be able when I get back to Chicago to tell my friends Bonney and Butterworth that this Association is interested in the work and suggests this, that, and the other thing, just as I came here charged by them with an expression of interest in you and desire for your welfare. I do not think that Mr. Bonney or the Directory is at present ready to guaranty publication. I know it is hoped that provision may be made for them, but as yet no formal and definite conclusions have been reached. There are difficulties in the way. Here and there will be an association that will say: "We propose to control the publication of our proceedings ourselves;" while others will say: "We shall be glad to have the Government or some outside association publish our report;" and my own hope—I can use no stronger word—is that a very considerable fund will be available for the publication of the proceedings.

Mr. WILLITS. What I have said was said in no spirit of discouragement. It was only for my own information on that point that I asked the question. I consider the subject one of great importance, and I would say to Professor Morrow and to the Association generally that wherever and however the Department can coöperate with you it will be most happy to do so. As to the matter of expenses, our appropriations are limited not only as to amount, but to specific objects, and the money can not be diverted in any way. However, before the time passes, we may be able to get from Congress, an appropriation that will enable us to help in some specific direction.

The CHAIRMAN. If Secretary Willits will allow me, I would like to ask one question for my private edification. Is there no money in the Department of Agriculture that can legally be diverted to the printing of reports on Agriculture? I mean reports of agricultural meetings; for instance, such as this Agricultural Congress. According to the ordinary way of doing business in the Department, is there no money that can be used for that purpose?

Mr. WILLITS. No, we have a printing fund for our own work and for the results of work done at the experiment stations.

The CHAIRMAN. Can you not make the printing of the proceedings of this congress a part of your work?

Mr. WILLITS. We can not; we are not charged with it, and even if we were, we are limited as to amount. But, as I have said, I hope that before the time comes we may have a lump sum that can be handled in some way or other for the general good. These reports of the proceedings at Champaign, which have just been distributed, we did consider as part of our work, although it is not all our own; I mean to say that it is very largely your work, but we coöperate in the publication of the proceedings of this very Association, because we are charged with the editing, printing, and publication of results of experiments, so that it is very proper that we should publish these discussions; but we can not take in any outside matters over which we have no legislative control.

Mr. MORROW. A single word further. The nature of the report made by our committee and of the questioning thereon has compelled me to confine my remarks almost entirely to the agricultural side of the matter. Many persons interested in different lines are present in this audience, and I wish to call your thought to the fact that the whole realm of science in its various relations, but particularly the natural sciences, will be represented at Chicago in a series of congresses. I bespeak your interest in the matter, and trust that you will endeavor to keep yourselves informed as to what is done in the lines especially attractive to you, giving what aid you can in their direction. To prevent possible misconception, I will add that while we are proud of Chicago and think that the people living near there are fairly good people, it is not the belief of the Exposition managers or of the Auxiliary managers that nobody lives outside a radius of 128 miles from that city; but for convenience of consultation the Congress Auxiliary has had to draw the line so that the men shall be reasonably near at hand. President Bonney honored me by asking me to name the chairman of a most important scientific committee. I named two or three New England men, and although they were admirably qualified he said the one selected would have to be reasonably near Chicago, as otherwise, however valuable he might be personally, he could not do the work which must be done at this time; so that it was out of the question to appoint one of the Eastern men. Finally I had the pleasure of naming the president of one of the institutions represented here, and my suggestion was at once adopted.

The report was accepted.

Mr. ALVORD. I move that the committee on the World's Columbian Exposition be continued until the close of the Exposition. I hope that before my motion is agreed to it will be properly considered.

Mr. CURTIS. I believe some action was taken as to that at the last meeting.

The SECRETARY. I would say that I have just found the resolutions referred to, and will read them. They are printed on page 73 of the Proceeding of the Champaign convention:

Mr. Armsby reported for the committee appointed to consider the advisability of a coöperative station exhibit at the World's Columbian Exposition, as follows:

Resolved, That in the opinion of this Association it is advisable to have a coöperative station exhibit at the World's Columbian Exposition.

Resolved, That in order to formulate and carry out such preliminary steps as are necessary during the year, a special committee, with power to represent the Association, be appointed by this convention to coöperate with the U. S. Department of Agriculture, and to take such other action as may be necessary.

Resolved, That the executive committee be authorized to pay from the funds of the Association the actual and necessary expenses incurred by the special committee aboye provided for, in the discharge of its duties.

On motion of Mr. Turner, the resolutions were adopted.

On motion of Mr. Alvord, it was ordered that a committee of five station directors be appointed by the Chair to carry out the plan proposed in the resolutions just adopted.

The President appointed Messrs. Armsby, Thorne, Morrow, Tracy, and Henry.

That is all that appears as to the permanency of the committee.

Mr. ALVORD. It was then apparently a committee for the year, and should at least be continued now that its report has been received and adopted, as otherwise it will cease with the adjournment of this convention. Hence, my motion is made to bring the subject of its continuance before the meeting.

The motion was carried.

Mr. ALVORD. For the purpose of accomplishing as much business to-day as possible, I will now make another motion, which is suggested to me by remarks made on the floor this afternoon in regard to this Congress Auxiliary. It seems to me that there should be some action by this Association in connection with the subject presented to us; that it is advisable to have the connection between the Congress Auxiliary and our standing Exposition committee maintained. Such action has already been inaugurated through Professor Morrow. In connection with the adoption of Dr. Armsby's report, I move that a special committee be appointed by this Association to coöperate with the Congress Auxiliary in relation to the agricultural congresses proposed, such committee to consist of Professor Morrow, the President of the Association, and the Assistant Secretary of Agriculture.

The motion was carried.

Mr. WOODS. I move that the program proposed by the executive committee be accepted and adopted as the program of this convention.

The motion was carried.

The CHAIRMAN. It will now be in order to discuss the question marked *a* on the program, which is as follows: Is it desirable to have a collective exhibit of the agricultural colleges in the agricultural building of the World's Columbian Exposition?

Mr. ALVORD. To explain the appearance of this subject upon the program I wish to state that through communication with our standing

committee on the Exposition it became known that Mr. Buchanan, chief of the department of agriculture of the Exposition, strongly desired that there should be placed in the agricultural building a collective exhibit of the agricultural colleges, whether those colleges were represented elsewhere or not, and he wished to have the matter brought before the present meeting of this Association. Therefore it was put upon the program, and two gentlemen representing widely separated agricultural colleges were asked to consider the subject and be prepared to open the discussion thereon. Neither of these gentlemen is present. If any will volunteer I think the question should now be taken up, otherwise it might be well to go on to the next topic, reserving this for a later time. The topic next in order is the question as to the weather service, which is of interest to the stations as well as the colleges, and preparations have been made for its consideration at any time this afternoon when it shall come up.

Mr. WILLITS. I would like to have it brought up at once, for I wish to be present when it is discussed, and I desire to return to the Department.

Mr. ALVORD. You wish to have the weather service matter first?

Mr. WILLITS. Yes, if the order can be changed. I do not know that it makes any difference which subject is considered first.

Mr. SMITH of Minnesota. I move that we next consider section *b* of the program, passing section *a* temporarily, to be called up later.

The motion was carried.

The CHAIRMAN (reading). *b*. What coöperation is desirable between the colleges and stations and the Weather Bureau of the Department of Agriculture?

Mr. WILLITS. I did not propose to make any extended remarks. It is desirable that there shall be as much coöperation as is possible and practicable. In my opinion there is really no limit to the desirability; but my short experience since the transfer of the Weather Bureau to our Department has shown me that there are difficult questions with reference to this coöperation. I started off with the idea that we ought to make every agricultural college and experiment station a permanent station of the Weather Bureau, fully equipped. In Michigan I organized the State weather service in connection with the State Agricultural College; that is to say, I was then connected with the college, and was the principal factor in getting the appropriation under the charge of the State board of agriculture, the trustees for the college. My idea was that we should have the weather observations and reports made at the station itself, and that the man who did that work should be enlisted in the work at the college, should be a professor of meteorology, and should take the boys in hand and teach them meteorology.

Now that was my idea. It was not completely realized, but we did have more or less of these observations under the eyes and the study of the students. Now I find as a matter of fact that the Weather

Bureau is a great organization, with its stations located largely at commercial centers, and necessarily so on account of the superior facilities for transmitting intelligence. They must be located where the best means of collecting and disseminating the information are available. That is a fixed fact politically, commercially, and in every way, and I find that the drawing power of a State capital or the great commercial center of a State, with its newspapers and lines of telegraph, is altogether stronger than that of any college can be. But unfortunately for this purpose most of our colleges are located at remote points which afford comparatively small facilities for dissemination of reports, etc. Take the case of Virginia, whose college is away off at Blacksburg, 7 miles, I believe, from a railroad; and so, too, in other States we find them scattered around here and there, and this makes it difficult to carry out the program I have in mind. You may ask why we can not have two stations. Well, there comes in the matter of expense. The money is appropriated for the plan as it exists now, and we can not duplicate the work without doubling the expense so far as the stations are concerned. So I have not yet formulated in my mind, in considering this new sphere of departmental activity, any plan by which the idea I had held could be even approximately carried out.

This, however, is true, that so far as may be the Department of Agriculture wishes to be in communication with these colleges and scientific institutions and to coöperate with them in their studies. It wants to have these institutions as a breeding ground for its observers, wherever they may be placed. It was charged by the persons who advocated retaining the service in the Army that the prestige of the service could not be kept up if taken from under the military discipline. Men enlisted for 5 years and stationed at Pikes Peak or in Arizona had only to obey as soldiers, going and staying until their time was up or until they were relieved—an enforced service. We were told that it could never be done otherwise; that if it were attempted we would find plenty of willing people for the desirable places but none for the undesirable ones, which nobody would take unless ordered to them under the Army discipline. But there are in scientific investigation ties stronger than any orders. A young man who understands botany and entomology and all these underlying sciences will be willing to go into the wilderness, at least for a short time, and study Nature as he finds her there. And so I still have the hope that in some way or other we may become so associated with the agricultural colleges in this work that when young men enter the service as observers they will say, "We are ready," and will take up their studies and go, and not simply to serve perfunctorily. We want observers who know something beyond the mere recording of rainfall, temperature, and wind, acting as automatically as do their thermometers and barometers; we want wide-awake young men, with minds willing to study Nature in all her phases, wherever they may be, and in that sense we hope for greater results.

Some days ago I received a letter from Professor Scovell in reference to his own station. I replied that the subject had been referred to the Weather Bureau, and that I would see to it that the Department or the Weather Bureau should be represented here when this topic came up for discussion. Professor Harrington, as I stated a short time ago, leaves to-day for Europe, and Major Dunwoody, acting chief, will not be here until to-morrow; but Professor Harrington has prepared a paper which I would like to have read at this time. I do not know what his plan is, but I know that he feels very much as I do on the subject.

Mr. A. L. Colton, confidential clerk to the Chief of the Weather Bureau, was introduced by the Secretary.

Mr. COLTON. Professor Harrington desires me to express his regret that he can not be here. He left with me a memorandum to be read here by Major Dunwoody, but that gentleman is absent and will not return until to-night, so that the best I can do is to read this rather brief paper, in which my Chief expresses his views upon the relations between the agricultural colleges and the Weather Bureau.

Mr. Colton read the paper referred to, as follows:

METEOROLOGICAL WORK OF AGRICULTURAL EXPERIMENT STATIONS AND AGRICULTURAL COLLEGES, AND THEIR RELATIONS TO THE WEATHER BUREAU.

The relations which should exist between agricultural experiment stations and agricultural colleges and the Weather Bureau are not easy to define. It is not difficult, however, to state what kind of meteorological work experiment stations and agricultural colleges should perform. For two reasons they should not be telegraphic meteorological stations: First, they are not in a position for sending and receiving telegraphic observations generally. The stations where observations are received and sent telegraphically must be selected with reference to ease of telegraphic communication. The requirements of their selection will not usually admit of experiment stations or agricultural colleges. Secondly, some of the work required of telegraphic stations, which must be done rapidly and at certain fixed and often unusual hours, can not well be done at experiment stations or agricultural colleges.

Again, in general, agricultural experiment stations and agricultural colleges should be located in the open country, and therefore can not be made central stations for State weather services. The latter should be located, where possible, at commercial centers.

Nevertheless, there is a large field of meteorological work which agricultural colleges and experiment stations can very properly occupy and which should be assigned them. They should generally be made meteorological stations of the first order, on the international plan, and their special duty should be climatological research. A station of the first order is, in general terms, one where hourly observations are taken and recorded by self-registering instruments. These observations are especially suitable for climatological work; they should be taken in some quiet place; the observer should have ample leisure to watch his instruments and assure himself of their accuracy, and afterwards the observations should be carefully reduced by the observer. All this requires much time and care on his part. The conditions at experiment stations and agricultural colleges are peculiarly adapted to this kind of work, and moreover this work is of especial interest to agriculture. The observations referred to should be published in full and on the international plan.

To this general climatological work these stations should add some special meteorological investigations, such, for instance, as the relation of forests to climate, reactions of the soil and climate, the influence of climate upon vegetation and the influence of vegetation upon climate, the relation of the stages of plant growth to the season, and similar topics. Such work is already performed by similar stations in the Old World, especially in Germany. As an example of what such stations should do in this class of work, I would suggest the investigations carried on at the station at Munich, in charge of Professor Wollny.

It is difficult to say exactly what the relations of the Weather Bureau to these stations should be. The Bureau should undoubtedly furnish the instruments used at the stations, or at least should ascertain their corrections and certify to their accuracy. The Weather Bureau should also have the instruments and the work inspected from time to time to insure uniformity, and the work at the different stations should be planned after that of the Bureau itself. But it is not easy to say what should be done with the results. Purely meteorological results probably ought to be reported to the Bureau, and agricultural work should probably be reported to the Department. It might be well to place the meteorological work of the experiment stations and agricultural colleges under the more direct charge of an officer who should be at the head of a subdivision of the records division of the Weather Bureau. A temporary arrangement of this sort could be made, and this changed from time to time as appeared to be best, until in the course of time satisfactory relations could be evolved.

I will say, in conclusion, that it would give me the greatest pleasure to coöperate with the experiment stations and the agricultural colleges in the pursuit of meteorological work. Any assistance the Weather Bureau could give them would be gladly extended.

M. W. Harrington,
Chief of the Weather Bureau.

Mr. Roberts (Vice President Porter in the chair). It seems to me, Mr. Chairman, that we are traveling in the right direction. The Department of Agriculture at Washington should have entire control of the Weather Bureau, and the work should be done at the experiment stations and agricultural colleges. I am somewhat tired of reading that two tenths of an inch of rain fell at Coney Hollow last week, when by climatic influences the storm swept millions of dollars' worth of fruit out of our State, and no true scientific agriculturist, capable of studying, has any means of knowing what effect the climate has in the case. Last year all our apples and nearly all our other fruit crops failed on account of climatic influences; and every week I read in certain papers a crop of Weather Bureau reports of petty things that mean nothing, as it seems to me, or very little. I am not now referring to the Agricultural Department only. I hope that before this convention adjourns it will pass some resolution which may strengthen the hands of the Secretary of Agriculture, and that this whole business will be placed where it ought to be placed and where it can be of the greatest possible good to the country. If it is necessary to telegraph along the coast that there is a storm coming that can be done by the worker at the station, who understands botany, horticulture, chemistry, and a dozen other things. I have now in mind a station where a carpenter goes out and looks into a tube and sends a dispatch somewhere or other, I don't know where, but I don't believe that it helps the farmer at all; at any rate I can not see that it does.

What I mean to say is that the main work of the Weather Bureau should be to define our climate and get the facts with which to go at this forestry question immediately, for that question, as you know, can not be deferred much longer. I believe that if we were to go at the rate we are now going it would be less than half a century before America would have to import her wheat, oats, and cattle. This subject must come, and that very shortly; so it is high time for the Department of Agriculture at Washington to find out the amount of moisture and the amount of heat and the kind of soil, and so on, throughout the various districts of our country, where we need to reclothe the earth with trees. We have a great American desert. The Weather Bureau will never clothe it with trees. If that is ever done, it will have to be done by the Department of Agriculture. I do not care to offer a resolution, but I feel very deeply upon this subject, and I wish that I knew how to change this whole condition of things so that we might get at our agricultural colleges and experiment stations some facts which would enable us in the near future to cover our hills—yes, and even some of our valleys which are worn out—with forestry, with plants. Certainly we are here to take the initiative and get ahead, not to go on in this eternal train. I hope that you, Mr. Willits, will formulate such a resolution as you wish. Do not be ashamed to father it, and I will second it, and do all I can to get it through this organization, to strengthen your hands, so that you may get hold of this whole subject and manage it.

Mr. Willits. I do not come forward with any resolution, but on this climatic question I am a good deal of a "crank." The Smithsonian Institution inaugurated this work of receiving reports of observers recording the state of the thermometer, the direction of the wind, etc., and did a grand work, but of course a large mass of unreduced material was accumulated. After a while the Smithsonian Institution abandoned this and the Signal Service took it up, and these collections made from year to year have never been fully reduced or investigated with the idea of finding a climatic law, but largely for the purpose of predicting storms. Now these predictions of storms are important and should not be neglected. You will find it fascinating and charming to take the report and see a storm start in the West and march in a grand sweep across the continent; but I think I speak the sentiment of the Chief of the Weather Bureau in saying that while we do not desire in any way to impair that service, we do desire to ascertain the relations of climate to vegetation, the different conditions, the different laws, and what modifications come from the lakes, streams, and forests, and all that, and to discover some law by which we can determine what can and what can not be done. The other day when I visited the Bureau I found one professor engaged upon a mass of material covering 25 years of observation. His duty is to find in it somewhere the governing law. Twenty-five years is a pretty good parallax, and

if you have a man of sufficient brains he can reduce these observations to a law. That is our great difficulty; we can all see that it ought to be done, and an effort will be made in that direction more emphatic than heretofore. That is the great fundamental agricultural question, and what Professor Harrington means is that you should not be made mere instruments for telling by telegraph that a storm is coming, but your brightest minds in the colleges should be set to study meteorological questions with regard to climate, and he is ready to help you by making your institutions stations of the first order and furnishing the necessary instruments.

I have a letter from Major Dunwoody on the subject, and he states it a little differently from Professor Harrington, who was absent at the time this letter was written. I will read it as giving something of Major Dunwoody's idea.

U. S. Department of Agriculture,
Weather Bureau,
Washington, D. C., August 1, 1891.

Sir: With reference to your communication of the first instant (accompanying the letter of Mr. M. A. Scovell, director of the Kentucky Agricultural Experiment Station, asking for the reëstablishment of the station of this service, formerly at Lexington, Kentucky), in which you request a list of all the agricultural colleges now in coöperation with this Bureau as volunteer or actual stations, and suggesting that some line of policy with relation to the general subject of coöperation between the Weather Bureau and the agricultural experiment stations be outlined with reference to the question under that head to be discussed at the meeting of the Association of Agricultural Colleges and Experiment Stations to be held in this city from August 12 to 18, 1891—I have the honor to recommend that the offer be made, on behalf of this Bureau, to furnish the experiment stations and colleges, at the expense of this service, with standard meteorological instruments; that these be visited by an inspector of this service; that the instruments be properly located as prescribed by this Bureau; and that regular reports be made on blanks which shall be furnished by this Bureau. It is suggested that the advisability be considered of having these experiment stations placed in charge, under this Bureau, of the State weather services in their respective States, where it is found to be practicable and advisable. It will probably be found, however, that the cases where this can be done are very rare, for as a rule the headquarters of the State weather services are now well located. The features of collection of reports and distribution of bulletins, warnings, etc., are of the first importance and should always determine the location of headquarters. While, therefore, it may be of advantage to change the location in some cases, the matter should not be disposed of hastily by the adoption of any general rule, as each individual service requires careful consideration. Certainly this Bureau will do everything practicable to encourage the heartiest coöperation between the Weather Bureau and the agricultural experiment stations and colleges.

With reference to the statement required as to agricultural colleges now in coöperation with the Weather Bureau, either as volunteer or actual stations, it is requested that your Department furnish this Bureau with a list of all agricultural colleges and experiment stations, their location, etc., and report will be made of such of them as are in coöperation with this Bureau.

Very respectfully,

H. H. C. Dunwoody,
Acting Chief of the Weather Bureau.

Hon. Edwin Willits,
Assistant Secretary of Agriculture,
Washington, D. C.

Now, as I understand Professor Harrington, his desire, if we may use that term, is to use these colleges and experiment stations as the right hand of the Weather Bureau in studying this very question of climatology, and the meteorology of the locality and its effect on plants, their growth, etc. In a certain sense we are in the dark, but that is the direction in which we are looking, and if there is anything that we can do under the law, with the money appropriated, which will be for the benefit of agriculture, I think I may say that Secretary Rusk will do it every time.

Mr. SMITH of Minnesota. In order to bring the matter to a terminus, I move that the paper of Professor Harrington, together with the prior and subsequent discussion in regard to this subject, be referred to a committee of three, who shall, after consultation with Professor Harrington and other officers of the Department, formulate a plan of coördination between the stations and the Department, and report to this convention at a later stage.

Mr. ALVORD. I second the motion, and would like, if we have time, to say a word or two more on the subject. After thinking of this matter a good deal I do not quite accept Professor Harrington's objection to doing more in the way of telegraphic service from the colleges and stations. When it comes to the matter of printing and distributing reports it becomes important to be at or near commercial centers with good facilities; but the mere matter of telegraphic communication can be as easily established and as well conducted at and from our colleges and stations as at the busiest towns in the States. While the law transferring this service to the Agricultural Department was being formulated and passed, special pains were taken to show the reason why the transfer should be made and what should be expected as its result. I read the law at that time together with others here present, and also with some not connected with our Association. I wish I had a copy of the law here, but without attempting to quote its language I will say unhesitatingly that in two essential places in the act of transfer, one in the enacting clause and the other toward the close, it is stated that the reason for this transfer was to make the weather service of greater use and benefit to the agriculture of this country, and that it was the expectation that the transfer would result in making such developments and improvements in the service as would make it especially valuable to the agriculture of the country, the aim in providing for additional money, etc., being to develop the utility of the service on that line rather than on a commercial line. Now up to this time in the operation of the weather service the agriculture of the country has had all its weather served to it, so to speak, not only from the commercial centers, but from the commercial standpoint, and the predictions generally issued in the several States that have no State services are based not upon observations taken in the country and telegraphed to the commercial center, but solely upon a single set of observations and

a single set of instruments located in a large city, which has no sort of climatic relation to the country surrounding it or to the agricultural districts to which they are sent throughout the State. Take Baltimore for example. I will risk the submission of the statement to experts in meteorology, but as an amateur I will venture to prove that the conditions existing at the only place in Maryland where official observations are made upon which to base predictions is so located that its facts of record are contradicted daily by observations just as good, taken at numerous places within a few miles by volunteer observers, who do not report to that central office more than once a week or once a month. I believe it to be true that in the agricultural districts the weather service predictions have been most generally accepted and have proved most reliable and most beneficial to agriculture where a State weather service has been established, having its ramifications in the country and its headquarters at an agricultural college or State university. I could cite many instances exemplifying the fact that the service of most advantage to the agriculture of the respective States of the Union has been a State service under the auspices and general control of officers of State agricultural colleges or institutions of a kindred character. So that I believe the service of the Weather Bureau itself may be expected to improve by taking in these State organizations, and that an effort should be made on the part of the Bureau to establish closer relations with the colleges and stations; and I think that more than is now indicated by Professor Harrington in his communication can be done in the way of bringing these institutions into active coöperation with the weather service, even as telegraphic stations. But there is another point which has been alluded to by Mr. Willits, and is referred to, if I recollect, in Professor Harrington's letter, that I think worthy of consideration, and that is the establishment of relations between the service and the colleges which will make the colleges the recruiting ground for the force of the weather service itself, and which on the other hand will bring in the weather service to the aid of the colleges in perfecting and adding to their meteorological instruction and in interesting the students in this important branch of science as related to agriculture.

One other view of the subject, and then I am done. I do not believe that those who thought the service could be bettered by transferring it to the Department of Agriculture can realize all that may be done for agriculture by the weather service until its sphere is so enlarged as to include what we may call, for lack of a better term, the meteorology of the soil as well as that of the atmosphere—what is called in foreign countries "agricultural physics." I believe that to take observations and have knowledge of the conditions and changes of the atmosphere, and shut our eyes to the physics of the soil and all of its changes and problems, is simply to throw away the time we spend in agricultural observations, because it is to take but one of two successive steps, and

that the one of less importance. I believe we must extend this work of meteorology to the consideration of problems in the physics of the soil, and that that is a proper department and branch of this work, since it largely calls for the same men and the same appliances; at least if the service must be organized anew that is the character of organization now in existence which can best be utilized to accomplish the work. I therefore hope that in considering how the new weather service can be made of greater value to agriculture this branch of the subject will be given attention and brought into the work. I think, therefore, that when this discussion is concluded, it should, as suggested by Mr. Smith, be referred, together with the paper presented, to a special committee to report back to the convention.

Mr. SMITH. The subject is of vital importance in Minnesota, which is the birthplace of the cyclone. It is interesting to study the development of the cyclone. Some of our corps have lately witnessed the agglomeration of clouds which resulted in a cyclone. I am interested in this work, and am glad to have made the motion, which, if carried, will refer the matter under discussion to a committee. I wish that it may be thoroughly discussed, and I am sure I express the feelings of all in saying that we are willing to do anything we can as station workers in developing the service, although I do not think we shall have very much control of the weather after all.

Mr. BATTLE. For 4 or 5 years we have had a State weather service connected with the experiment station in North Carolina; it is the meteorological division of the station. Fortunately both the station and the college are located in the central part of the State, at a commercial center, so that we can very easily disseminate to all parts of the State reports as to frost, cold waves, weather indications, etc. We consider ourselves fortunate in this respect. I will state also that we have always endeavored to manage the weather service in the interest of agriculture. We have in different parts of the State meteorological observers, many of whom are the superintendents of the coöperative field tests, so that the meteorology of the various sections can be studied in connection with the growth of the crops. We publish a weekly weather and crop bulletin, made up from the reports received from different parts of the State, numbering nearly two hundred. In this way we can keep track of the growth of the crops and of how they are effected by the weather. The Weather Bureau at Washington has very kindly coöperated with and aided us in all our work. The Bureau has detailed an observer, who is the meteorologist of the station, and pays him for his time and for his work. Without that coöperation we could not maintain the work, and I wish to acknowledge right here the benefits we receive from it.

Mr. FREAR. I desire to add a word in line with the remarks of Mr. Alvord with reference to the location of the Weather Bureau stations as bearing upon their ability to represent the climate of the country. In the

first place we well know that the temperature of a city (even though everything be done that is possible, by means of proper shelters, to protect the instruments from direct radiation) is, especially at night, different from that of the surrounding country, owing to the nature of the buildings of which the city is composed. In a city we can not expect to have the same conditions of temperature or humidity, and consequently of precipitation (frost), that we have in the surrounding country. Again, frequently the centers of population and of commerce are similarly situated so far as the general topography of the State is concerned, and therefore fail to represent large regions which are important from an agricultural standpoint. Take our own State of Pennsylvania for example: We have a weather service observer in Philadelphia; we have one in Erie; we have one in Pittsburg. Some time ago it was desired to increase the number, and to have the central mountain region of the State with its rich valleys—very important in the agricultural part of the State—represented. Harrisburg was finally selected as the place. Now Harrisburg is just 100 miles west of Philadelphia, and is situated in a valley in the eastern part of the State, in a region representing that rather than the central mountain part of the State. Attempts were made to have another location chosen. In that case, however, politics entered in somewhat, and Harrisburg was selected. It does not represent the central mountain part of the State, as our State weather service records will clearly show. The Pennsylvania Station has paid a great deal of attention to the matter of weather observations ever since its organization, as indeed did the college before the organization of the station. We have done what little we could in the coördination of observations and crop development, and I am sure I represent the feeling of the station at large in saying that we have tried to do all we could in that direction, recognizing it as an important function. But we feel, at least I personally feel, that the Department and the Weather Bureau can do a great deal more for us in the line suggested by Mr. Alvord than has heretofore been done, and it was my hope when the transfer was made that a distinct effort would be made in this regard, with proper organization, and under proper direction.

Mr. JENKINS. I would like to say one word with regard to those stations where no meteorological work is done. It seems to me that we are waiting for some central office or competent meteorologist to show us a plan by which we can hope to gain something more by making observations than simply filling up our annual reports with the rainfall, temperature, etc. At present there is no one on the station staff who is competent to digest these observations after they are made and make them of practical use. If there was we should certainly go into the business of making observations. Just now the observations for the Connecticut Valley are made on the roof of a tall insurance building in the center of a city. Five years ago, as a concession

to the agricultural interests, a rain gauge was put in the center of the green below, and this was at the mercy of every naughty dog that wished to show his spite against the administration. Now, Mr. Chairman, as soon as we can be assured that our observations will have any permanent value, that is as soon as there is anyone in Connecticut or anywhere else who can take our observations and digest them and make such use of them as shall be of benefit to agriculture, we shall be delighted to take hold of the subject. We are favorably situated, not in the city, but close by it; in communication every hour, day and night, with the telegraph office by telephone; we are at a railroad and commercial center, and we wish to do everything we can which will be of any help to the agriculture of Connecticut, but as things have been in the past we have seen no chance of usefulness in making meteorological observations. As soon as the Department of Agriculture can present a plan which shall make it appear that there is money in it for farmers—that any agricultural use can be made of the results obtained—we shall be delighted to coöperate in every way possible, and I presume other stations are situated as we are or I should not have spoken on this matter.

Mr. DABNEY. I think that the Chief of the Weather Bureau has outlined the principles of organization in the paper presented, and that Dr. Jenkins in his remarks has struck the keynote of the work that is to be done. It is well for us in considering the work to be undertaken by colleges and stations to look to our charges—what are we for? The colleges are to teach the science of agriculture and the experiment stations are primarily to conduct the research in those sciences. One way to secure the work to be done is to try to exclude things that ought not to be done. It seems to me that in the colleges we should avoid everything in favor of the commercial part of this work; that we should not do what can be done by any one else. It is an open secret that the chief reason for the transfer of this Bureau to the Department of Agriculture was to make it do good to the farmers and make it a scientific bureau. The Bureau had gotten into working in a routine sort of way, and while it employed experts in Washington, more were needed in the minor positions. The employés (sergeants, etc.) in charge of the smaller stations being mere routine workers, young men having but limited education were taken up and instructed for a few months in the mere processes of taking observations, and were then put into the service. They were not scientific men in any sense of the word; they were merely mechanical workers, and as such totally unfit to do any really good work. In many cases, having no real sympathy with their work—being mere hirelings required to do work certain hours in the day—they slighted it. I have heard jokes about the way they took observations. They frequently guessed at the facts, frequently misread the instruments, and in various other ways made mistakes to be expected of that class of men—not scientific men. These mistakes were

often innocent, but there were wicked mistakes too. We believe that will be remedied and that the Bureau will be made strictly scientific. If so, how can we help the Weather Bureau? That is the question.

The first thing, it seems to me, is the need of scientific work and of scientific men to fill these minor positions. Now, it would seem proper for the agricultural colleges to undertake, as has been suggested, the training of these scientific observers, letting this be a part of their teaching. On the other hand, as has also been already suggested, there is vast need of research. The work of the Weather Bureau has been confined too much to the accumulation of data and the publication of warnings, storms, frosts, and so on. It has given us no law, and a vast amount of the material obtained has not been worked up. To-day we know very little about the climate of our country. When it comes to the climate of any particular section of this country it is almost impossible to get any data whatever by which to formulate opinions to determine what crops can be grown there.; so that we must have the beginning of the work in studying our climate in various sections of the country, and it must be begun as a scientific study. This implies a vast deal of scientific research, and it will be necessary to have in the Weather Bureau a scientific department, devoted exclusively to the consideration of scientific questions underlying these laws. The observers might wisely be located at the experiment stations, so that we might have in connection with them well-kept observing stations, with men in charge who could teach in the colleges while carrying on their investigations, just as our other scientific experts do. If such a grand system of scientific research in meteorology is to be established it should have its center in the Weather Bureau and the Government should furnish the means as well as the apparatus. I, for one, think that our college and station would not like to undertake this work unless there were some provision for men to be employed—salaries, etc. We have all we can possibly do now, and I believe that undertaking to do too much is one of the most common mistakes made by our colleges and stations, especially by the stations; we are trying to do too many things. We can not undertake to make research in meteorology without additional aid; we want an expert when we undertake it in our State, and we want the very best instruments. When these are provided we are ready to begin, but not until then.

The CHAIRMAN. The motion of Mr. Smith, seconded by Major Alvord, is for the appointment of a committee to which shall be referred the whole subject, with power to report to the convention at some later time. Shall I put the question?

Mr. WOODS. Was it the intention to have the committee report to this convention or to the Association at a subsequent convention?

The CHAIRMAN. To the present convention.

Mr. WOODS. Was not the name of a gentleman who sails to-day for Europe included in the names of those with whom the committee were to consult?

Mr. SMITH. Yes, Professor Harrington was named, but I said "and other officers of the Department."

The CHAIRMAN. The communication of Professor Harrington, as I understood the motion, was to be referred to this committee.

The motion was carried.

The CHAIRMAN. The committee appointed will be announced at the evening session.

Mr. ROBERTS. I have a resolution that I would like to present, but not for discussion at this time. It is as follows:

Resolved, That this Association most respectfully urge the honorable Secretary of Agriculture to use every honorable means in his power to secure the passage of a law or laws which shall exempt from sale or preëmption all Government forest lands now unsold, in order that all the Government woods, forests, and underbrush may be surveyed and reported upon with the view of preserving and surveying all woodlands belonging to the Government.

The resolution was referred to the executive committee.

The CHAIRMAN. The next topic is, *c*. Shall this convention hold an adjourned session at some other place the present year? If it is your pleasure to take that up now for consideration, the matter is before the Association.

The SECRETARY. It seems to me that had better come up in the latter part of our work, when we have some unfinished business. I move that it be deferred to a later time.

Mr. ALVORD. Allow me to suggest that this is one of the few opportunities we shall have for discussion and there is plenty of time before 5 o'clock.

The SECRETARY. I made the motion because something may arise to make us want a meeting in November, although I think we can get through with all our business here and shall not want another session.

The motion was lost.

Mr. ARMSBY. I move that the convention do not hold an adjourned session during the present year. I do not make this motion in any sense as a criticism upon the action of the executive committee in bringing up this question, but partly to bring the matter before us in parliamentary form and partly to express my own opinion as to the desirability of holding an adjourned session.

The SECRETARY. That motion if carried will not prevent a called meeting, I suppose?

The CHAIRMAN. No; the question before the Association is upon the motion that it is the sense of the convention that another meeting of the Association during the present year is unadvisable, unless it be a meeting called by the executive committee.

The motion was carried.

EVENING SESSION, WEDNESDAY, AUGUST 12, 1891.

The convention was called to order by the President at 8 p. m.

The PRESIDENT. The first 15 minutes will be devoted to general business. I will call on the chairman of the executive committee to read the roll of delegates.

Mr. Alvord read the roll as it stood at the time. (For complete list see p. 13.)

The PRESIDENT. The committee on the work of the Weather Bureau will consist of Messrs. C. D. Smith of Minnesota, A. W. Harris of the Office of Experiment Stations, and H. E. Alvord of Maryland.

Mr. ARMSBY. The report of the executive committee, presented this morning, contained a number of important recommendations to the Association upon which no action was taken. I move that a special committee of three be appointed by the Chair to take that report under consideration and report thereon to the convention.

The motion was carried.

The PRESIDENT. The Chair will announce the committee a little later.

The President then addressed the convention as follows:

GENTLEMEN OF THE ASSOCIATION: The great apostle of German materialism was wont to say in his lectures, "Miracles, gentlemen, are like pills, to be swallowed, not chewed." He was dealing with the supernatural and what is contrary to natural law. But in the vast realm of Nature and the investigation of her phenomena, the miracles daily performed before our eyes can not be carelessly disposed of in a moment, swallowed without consideration. The unrolling of the leaf, the budding of the flower, the maturing of the perfect fruit, the wonderful adaptation of parts to specific ends, the differentiation of various organs, as the filaments of certain plants for tactile organs, the lobes for capturing insects, and the glands for secretion and absorption—all these require the most careful and patient observation; all natural phenomena have their physical and natural causes, and to find out these underlying causes is often a morsel of the toughest kind, to be turned and re-turned, again and again before the final act of deglutition takes place and we are prepared to hazard an opinion. And these adaptations of nature are as countless as the sands upon the shore, each one in itself a wonderful physical miracle, only to be interpreted by the patient worker.

We are tempted to exclaim in the words of the magic song where Mephistopheles draws wine out of the table in Auerbach's cellar:

> Wine is grapes and grapes are wood,
> The wooden board yields wine as good.
> It is but a deeper glance
> Into Nature's countenance.
> All is plain to him who saith,
> "Lift the veil and look beneath,
> "And behold," the wise man saith,
> "Miracles if you have faith."

The rapt seer, looking over the broad field, exclaimed: "Animate and inanimate creation are mountainous and glittering with them. Down into the regions of the infinitely small, whither only the most searching microscopes carry the sight; up into the regions of the infinitely large, whither only mightiest telescopes lift our struggling vision; among the mechanisms of the atomic hosts that people a single leaf and among the mechanisms of those swarming celestial empires whose starry banners sweep our nightly skies, it is everywhere the same"—exquisite adaptations

crowding exquisite adaptations; means so exquisitely adapted to the end that every part stands in the most perfect balance and adjustment to the other. What more perfect illustration of this correlation of parts can be presented than in the family of the Vandeæ, where the related positions and shapes of the parts—the friction, viscidity, elastic and hygrometric movements, all nicely related to one another—come into play. Yet all these appliances are subordinated to the aid of insects; for when the retreating insect, having satisfied its quest, gradually worms its way out, the labellum springs back into place, the lip of the anther is lifted up, and the viscid mass from the rostellum, forced into the anther, glues the pollen mass to the insect and thus insures its transportation to some other flower.

Darwins and Müllers, it is true, are not born every day, but every man has within him the same elements of success if he will only use them aright, bringing to bear upon each problem the same patient, intelligent observation, adding link to link, till at last the lengthening chain stands perfect and complete. And yet there will always remain some problems that will baffle the closest scrutiny. "The deeper science searches into the mysteries of nature, the more clearly it evolves the symplicity of the means used and the infinite diversity of results. Thus from under the edge of the veil which we are enabled to lift a glimpse of the harmonious plan of the universe is revealed to us. But as for primary causes, they remain beyond the ken of mortal mind; they lie within another domain; which man's intellect will ever strive to enter and search, but in vain."

The German scholar who after a life of patient study of a single word, the relative pronoun, regretted on his deathbed that his efforts had been scattered and that he had not confined himself to a single letter of the Greek alphabet, is but a type of the labor required in establishing a single fact. Diffusion is weakness; concentration, strength; and the man who with divided energies studies a mass of facts is outstripped in the race by him who confines himself to one. It takes 10 years at least, said President Clark, to establish one agricultural fact, but it is on the aggregation of facts that stable law depends, and although we can not always see the immediate practical value of the addition of a new fact to the fund of knowledge, still no one can ever tell how much vital importance is hidden in it. The boy dallying with the steam issuing from his mother's teapot established the fact of its condensation, and forthwith became possible its application to all the tremendous enginery of modern science. Nor should a fact be despised because of its apparent triviality. The great father and founder of fruitful investigation, Lord Bacon, says: "The eye of the understanding is like the eye of the sense; for as you may see great objects through small crannies or levels, so you may see great axioms of nature through small and contemptible instances."

Not a single physical science can be named that has not been built up by the labors of men who were seeking for truth while those very labors were considered puerile and ridiculous by mere utilitarians. Every scientific truth, it has been aptly said, has to pass through three initial stages before it can be firmly established: First, that of denial and ridicule by the world; second, that of acceptance; and third, that of calm assumption that it has always been so. We are told that Pythagoras, when he discovered that the square of the hypotenuse was equal to the sum of the squares of the other two sides, offered up a hecatomb in grateful recognition of what had been vouchsafed him, since which time whenever a scientific truth has been discovered the oxen have always bellowed. The best scientific results of the present day which have not yet borne fruit—the questions that engage the attention of our scientists—are recounted with the same sneers and ridicule by those who claim to be practically wise as were observations in geology and experiments in electricity a century ago. "Every great advance in practical science in the last half century has been simply the combining or utilizing of materials and results wrought out as isolated products of facts, after long years of careful investigation, by the patient truth searchers in all portions of the world." The studies of Franklin, Volta, Arago, Henry, and Faraday in accumulating facts, discovering laws, and inventing instruments, made the electric telegraph a possibility in our day.

Those men prosper best in this world of universal inquiry who sit silent, watch longest, and accept most quickly each suggestion of change. The thrifty trees hug the earth and rocks with a thousand rootlets, feed on air with ten thousand leaves, and feel everywhere through and through them the throbbing force of life, but who can tell the countless generations through which they have stood, silently drinking in the sunshine of heaven and gathering and maturing their strength.

All theories are open to ceaseless inquiry and correction and we can expect to progress only by the patience, the breadth and the sagacity of our work in uncovering laws and methods of life in themselves very secret and obscure.

The fundamental working conceptions of science change with the changing knowledge of the facts they interpret, but the foundation remains the same, and he interprets best who penetrates most deeply to its heart and questions most closely its workings. The good agriculturist stands in a kind of awe of living things. He is diffident in the suggestions he makes to them, and if the hint is not taken he withdraws it at once. If any predisposition appears, he humors it immediately and is ready to stand a quiet observer in the presence of the putting forth of vital powers.

Variety is the initiatory step of all progress, and we may thankfully accept a score of unimportant foundlings, if after repeated failures we succeed in producing one serviceable one of lasting benefit to the human kind.

But the world is too impatient for results—like the Athenians of old, madly rushing about, ever seeking for something new. Progress is the cry of the age, progressive thought the pet pride of to-day. The charm of antiquity is broken. The historic tales of our childhood have faded into myth before the cold scrutiny of modern learning. The idols of the past are overthrown and trodden underfoot by the iconoclasts of the present. No doctrine is too sacred, no dogma too hoary for the levelers of to-day. Every year, nay every month, witnesses the birth of some new theory, some grand discovery in the laws of Nature, who in her old age seems as prolific of law as a continental congress. New creeds, new sciences, new methods are springing up like the fabled race of heroes from the uncanny sowing of the dragon's teeth, and all under the glorious reign of progressive thought. Well will it be for us if in this universal demand for something new, something strange, something out of the beaten track, we can heed the lesson of the hour and patiently watch and wait—watch though the world deride our waiting; wait till the harvest crowns our watching.

From the "seely wench," who, according to Platt, taught the art of setting corn by accidentally dropping some wheat seeds in holes into which she ought to have dibbled carrots and radishes; from the sowing of potatoes broadcast and the drawing of plows and harrows by the tails of the unfortunate horses in the eighteenth century, to the drilling and the sulky or steam traction plows of the present age, is indeed a great advance. The patient workers in this our chosen field have not been many, at least till we come down to our own time, and too often, alas, to quote the spirited words of another, "like the ancient alchemists have starved in the midst of their golden dreams. Tusser, teaching thrift, never throve. Gabriel Platter, the corn seller, who boasted that he could raise 30 bushels of wheat to the acre, died in the streets for want of bread. Jethro Tull, instead of gaining an estate, lost two by his horse-hoeing husbandry. Arthur Young failed twice in farm management before he began his invaluable tours of observation," and Bakewell, irrigating his meadows and raising four crops in a single season, was compelled to give up his farm, and died in comparative poverty. But each one has lifted the veil a little higher and left the way a little clearer for those who followed him. Tull, experimenting in drilling and horse-hoeing husbandry, all but divined the mysteries of chemistry, which then, as applied to agriculture, were undiscovered. Thaer, applying the natural sciences to agriculture, established a system of farm accounts, placing values on the various farm materials, and introduced the great principle of rotation of crops. Bakewell, discovering the principle of selection in breeding, raised to the

highest pitch of perfection his flock of Leicesters. Stock husbandry rose at a single bound and henceforth the "promiscuous union of nobody's son with everybody's daughter" was at an end. Davy, by his chemical analyses and explanations of agricultural processes, laid broad and deep the foundations of agricultural chemistry. Liebig, teaching the applications of chemistry to agriculture and the nutrition and growth of plants and animals, inaugurated the era of progress of scientific agriculture. Boussingault, whose careful analyses and experiments in connection with his investigations into the sources of the elements of nutrition for plants and the value of food rations for animals, led the *Agricultural Gazette* to say of his Economie Rurale that it was the most important and valuable book for farmers the chemists of the present century have produced. Stöckhardt, popularizing agricultural chemistry by his lectures and his writings; Mechi, laying down the rational principles of farm management; Henneberg, unfolding the mysteries of the physiology and economy of feeding farm animals; Ville, teaching the principles of complete manures; Grandeau, teaching the analytic methods of agricultural chemistry; Dehérain, for years conducting exhaustive field experiments; Maercker and Wagner, studying the application of potash, nitrogen, and phosphoric acid to the growing plant; the two Kühns, working in the respective fields of the physiology of cattle feeding and the chemistry of the respiration of animals; Wolff, in food rations, Pettenkofer in respiration; and the lengthening list closes with the name of one whose carefully conducted experiments for half a century have made the estate of Rothamsted a shrine for all true workers in the science of agriculture—a Mecca to which the devout repair as do the followers of the prophet to their holy city.

Fifty-seven years ago Sir John Bennet Lawes, entering into possession of his estate, commenced a few experiments on the effects of different manures upon potted plants and afterwards upon plants in the field. Led by the striking results obtained to carry on the same line of investigation on a broader scale, 9 years later he associated with himself Dr. Gilbert, turned a barn into a laboratory, and commenced that series of patient and exhaustive experiments which have won for him and his work a world-wide reputation. From the few experiments with potted plants of 1835 and 1836, and from a single associate working in a barn used for chemical purposes in 1843 his station has risen in staff and equipment to one of national importance, with its 60 or more broad acres permanently set aside for agricultural experiment; its trained staff of workers, chemists, botanists, veterinarians, computers, and recorders; its laboratory, presented by interested agriculturists in recognition of the importance of his work; its munificent endowment; its collection of over 40,000 bottles, containing the results of thousands of analyses, samples of the various animal and vegetable products, ashes, soils, etc., connected with the various experiments; and last, its manuscript library, a marvel in itself—thousands of pages, classified and indexed, containing a complete record of every ascertained fact; a life history, if we may so term it, of every experiment undertaken; a mass of all conceivable data on a great variety of subjects, tabulated and arranged for ready reference.

The chief work of Rothamsted may be said to consist of the classic investigations on—

(1) The assimilation and sources of nitrogen.
(2) The growth of mixed herbage on permanent meadow.
(3) The growth of wheat.
(4) The growth of barley.
(5) Animal composition and nutrition.

But the work has been by no means confined to these lines, as the following brief analysis of the subject matter of the papers to be found in the Rothamsted memoirs will clearly show. These memoirs consist of nine volumes, primarily having a fourfold division, thus:

(1) Original reports of investigations.
(2) Studies of special questions based on experiments at Rothamsted and

elsewhere; reports to Parliament and other bodies; and polemic articles, especially those written in the controversy with Liebig over his mineral theory.

(3) Abstracts of longer Rothamsted articles.

(4) General reviews and lectures, as for example those delivered at Oxford University, before the British Association for the Advancement of Science, the Royal Agricultural Society, and various farmers' clubs.

Of the nine volumes constituting the memoirs, three quarto volumes of 831 pages contain full reports of the three most celebrated Rothamsted investigations on the assimilation and sources of nitrogen, the growth of mixed herbage on permanent meadow, and animal composition and nutrition; and the remaining six octavo volumes of about 2280 pages are collections of variously printed and separately paged pamphlets.

The authorship in most cases is that of Lawes and Gilbert, either conjointly or separate.

Dr. Evan Pugh, late president of the Pennsylvania State College, was associated with them in the nitrogen investigations. In the more recent publications Mr. Warington's name appears, either alone or associated with those of Lawes and Gilbert. Since the first paper on agricultural chemistry, in 1847, one hundred and twelve have appeared on the following subjects:

Agricultural economy	3	Barley	4
Agricultural science	2	Leguminous crops	3
Agricultural chemistry	5	Turnips	2
Value and utilization of sewage	6	Potatoes	2
Rain and drainage waters	4	Vegetable physiology	6
Nitrogen of vegetation	10	Composition of certain animals used as human food	17
Soils and manures	11	Feeding experiments with sheep, pigs, and oxen	10
Grass	4	Miscellaneous	3
Mixed herbage	5		
Wheat	15		

Rothamsted has from the outset—and for nearly half a century—voluntarily placed itself at the disposition of the advocates and practitioners of advanced agriculture. Scientific and practical problems as offered have been accepted and faithfully and exhaustively worked out, regardless of expense either in time or money. Practical agriculture in all its possible bearings is represented in the publications, and hence the variety of the style of its writings, suited to the education of an audience at Oxford or to a farmers' club. All things have been laid under contribution and made to minister to it. The earth, the air, and the water have in turn given up their secrets. Like the All-Seeing One, the hundred-eyed Argus of antiquity, or Briarens of the hundred hands, it has suffered nothing to escape its close scrutiny and inquiry. From the pure raindrops of heaven to the drainage waters of the earth, and from the capture and imprisonment of the free nitrogen of the atmosphere to the composition, utilization, and value of town sewage, it questions them all, and whether they answer in the tongue of the chemist, the botanist, or the engineer, the answer has invariably been in the direct interests of practical progressive agriculture.

The value to agriculture of the work already accomplished is well-nigh incalculable. Far less can be estimated that of the future, for which, in the will of the generous founder, ample provision has been made. Of its immediate importance, English agriculturists speak in no uncertain terms. The author of the Pioneers and Progress of English Farming, referring to the experiments of Sir John Bennet Lawes and Dr. Gilbert, says: "The triumph of chemistry is summed up in the system of successive cropping without impoverishment, which has been established by them. It is difficult to estimate the enormous influence which their experiments have already exercised upon farming, or to assign limits to the increased productiveness of the soil which England might have witnessed but for the disastrous period of 1873–89."

Gentlemen of the Association: In my feeble way I have endeavored to outline to you the great work accomplished at Rothamsted. I have likened that station to Argus of the hundred eyes, to Briareus of the hundred hands. Those mythic impersonations of power and sight were dependent each of them upon the individual eyes and hands which went to make up their being. In like manner the strength of the station depends upon the individual character and make-up of its staff.

We have with us here to-night an eye and hand of Rothamsted—an eye which has not sought in vain the interpretation of Nature's problems; a hand which has most skillfully assisted the eye in these interpretations.

The President then introduced to the Association Mr. R. Warington, who delivered his lecture entitled The Rothamsted Experimental Station.*

At 9:35 p. m. the convention adjourned until the following evening at 8 o'clock.

Evening Session, Thursday, August 13, 1891.

The meeting was called to order by Vice President Porter at 8:15 p.m.

The Chairman. Gentlemen, it is a little past the hour appointed for our meeting. Before the commencement of Mr. Warington's lecture the executive committee has some business which it wishes to present. We will attend to that first, and then proceed to the lecture.

Mr. Alvord. I desire first to make an additional report from the committee on credentials as to the list of delegates. If any gentlemen have come in to-day I would be glad to have their names to add to the list as made up last night.

There is a clause in the constitution providing for the special admission to temporary membership in the Association (that is, during the life of one convention) of schools and colleges not eligible to regular membership under the constitution, and some of those institutions are represented here. The committee recommend that the following resolution be adopted:

Resolved, That there be admitted to representation in this convention the delegates present from the Agricultural College of Ontario at Guelph, the Storrs Agricultural School of Connecticut, and the State Agricultural School of Rhode Island.

The motion was seconded.

Mr. Morrow. While I think that we all recognize the fitness of the motion, I wish to express my individual gratification at this timely action of the executive committee, particularly with reference to our friends from across the line, and to say that both yesterday and to-day we have had most excellent help from the gentleman from Guelph, especially in the section on agriculture.

The motion was carried.

The Chairman. Gentlemen, we most cordially invite you to take seats with us at this time, and to participate in all the meetings of the Association.

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* This series of lectures is published in Experiment Station Bulletin No. 8 of the Office of Experiment Stations of the U. S. Department of Agriculture.

Mr. MILLS. In behalf of the institution which I have the honor to represent, and I may say in behalf of the Government of Ontario, I wish to return my sincere thanks to you, Mr. Chairman, and to the members of the Association for so kindly admitting me to membership in your body. I have thought for some time that I should like to be in some way connected with this great organization, which certainly represents the most important industry on this continent. I have no hesitation in saying that I am particularly gratified at the cordial invitation from this convention.

The CHAIRMAN. I will say to President Mills that himself, his institution, and the work they are performing are not strangers to this Association.

Mr. Alvord read the following communication:

STRAFFORD, VERMONT,
August 12, 1891.

MY DEAR SIR: I have received the finely engraved and superbly framed resolutions adopted November 13, 1890, by the Association of American Agricultural Colleges and Experiment Stations at Champaign, Illinois, expressive of their appreciation and thanks for my early legislative services in relation to the land grant colleges, and in the recent act of Congress for their more ample endowment; and I tender my grateful acknowledgment for the distinguished honor bestowed, and also to you, Mr. Secretary, and to your President for the courteous manner in which it has been communicated. I shall through life feel an abiding interest in the success of each one of the land grant colleges.

With great respect, I am,
Very truly yours,

JUSTIN S. MORRILL.

Major HENRY E. ALVORD,
Secretary of Association of American Agricultural Colleges and Experiment Stations, Washington, D. C.

Mr. ALVORD. Now to expedite business, as we shall not have another general session until to-morrow evening, I move that the president of the Association be authorized to appoint a committee of seven to nominate to the convention officers for the ensuing year.

The motion was carried.

Mr. ARMSBY. I desire to offer the following resolution for reference to the executive committee:

Resolved, That the executive committee elected at this meeting be authorized to appoint three delegates with power to represent the Association and to coöperate with similar representatives of the Columbian Dairy Association and of the various breeders of dairy cattle, in formulating rules for the conduct of the proposed tests of dairy breeds at the World's Columbian Exposition.

The SECRETARY. I have an announcement to make. The members of the Association are invited by Mr. E. A. Von Schweinitz, chemist, to visit the new chemical laboratory of the Bureau of Animal Industry at the Department of Agriculture.

President Goodell has appointed as the committee to take into consideration the recommendations made by the executive committee,

Messrs. H. P. Armsby of Pennsylvania, H. B. Battle of North Carolina, and C. H. Pettee of New Hampshire.

Mr. Warington then delivered his lecture entitled The Circumstances which Determine the Rise and Fall of Nitrogenous Matter in the Soil.

At 9:20 p. m. the convention adjourned until the following evening at 8 o'clock.

Evening Session, Friday, August 14, 1891.

The meeting was called to order by Vice President Porter at 8 p. m.

The Chairman. There are some matters of business to be attended to in general session before we call upon Mr. Warington for his next lecture. The president of the Association, Dr. Goodell, who, as you are aware, is obliged to be absent on account of illness, has presented the names of the nominating committee. The Secretary will please read them to the convention.

The Secretary. The names of the nominating committee are as follows:

F. A. Gulley of Arizona, W. H. Brewer of Connecticut, J. E. Hollingsworth of Texas, E. B. Voorhees of New Jersey, S. M. Tracy of Mississippi, J. W. Hatch of Virginia, and E. A. Popenoe of Kansas.

The Chairman. The members of this committee will please take notice that it is desired they should meet early in the morning and report at the 2 o'clock session to-morrow afternoon.

Are any of the special committees prepared to report?

Mr. Smith of Minnesota. The committee to which was referred the matter concerning the Weather Bureau is prepared to report.

Mr. Smith read the report of the committee, as follows:

Your committee having considered the matter referred to it, being the communication from the Chief of the U. S. Weather Bureau and the discussion thereon in the general session of the twelfth instant, and having conferred with the Acting Secretary of Agriculture, as instructed, respectfully reports the following resolutions and recommends their adoption, as the view of this Association upon the subject:

Resolved, That in the future development and extension of the Weather Bureau in the special interests of agriculture, the Bureau should organize and assist in maintaining a study of climatology in its relations to farming, in coöperation with the agricultural colleges and stations, and that the sphere of this work should be enlarged to include the physics, conditions, and changes of agricultural soils.

Resolved, That a special committee be appointed by this Association to confer with the officials of the Department of Agriculture in furthering the object stated and in bringing the same to the attention of Congress.

Clinton D. Smith,
A. W. Harris,
Henry E. Alvord.

It was moved that the report be accepted and that the resolution embodied in it be adopted.

Mr. EMERY. Before the vote is taken I would like to say a few words in regard to some strictures made upon some of the observers in the Signal Service. The strictures made in the discussion the other day were, in my opinion, unjust, and I think that they should be refuted. In the Signal Service there are a number of men, though not a large number, who enlisted from our agricultural colleges. These men have prepared themselves in as many branches of science as many of the men on this floor to-day, and I believe that their ability to make careful scientific observations of a higher order than the mere reading of instruments is as great as that of most of us. Wherever they may be located their work may be depended upon as being well done by men of careful, conscientious habits and real ability.

The motion was carried.

The CHAIRMAN. The motion carries with it the appointment of the committee. How shall that committee be appointed?

Mr. ALVORD. By the Chair.

The CHAIRMAN. I will appoint Messrs. H. E. Alvord of Maryland, A. W. Harris of the Office of Experiment Stations, and W. A. Henry of Wisconsin.

Mr. ARMSBY. The committee to which was referred the report of the executive committee has a very brief report to submit.

Mr. Armsby read the report, as follows:

Your committee, to which was referred the report of the executive committee, in presenting its recommendations, based thereon, desires to express also appreciation of the very faithful and satisfactory manner in which that committee has performed the duties intrusted to it.

It is recommended—

(1) That in accordance with the recommendation of the executive committee, each institution eligible to membership be invited to contribute $10 to the treasury of the Association during 1892, the same to be paid as early in that year as practicable.

(2) That in lieu of making any changes in the constitution at the present meeting, the executive committee to be chosen at this meeting be instructed to take into consideration the question of revision of the constitution, to present to the members of the Association in connection with the program of the next annual convention a statement of any amendments which they deem desirable, and to provide in the program for discussion of and action upon the same.

Respectfully submitted,

H. P. ARMSBY.
H. B. BATTLE.
C. H. PETTEE.

Mr. MORROW. I move that the report be accepted.

The motion was carried.

Mr. MORROW. The illness of Professor Plumb, chairman of the section on agriculture, has prevented him from completing a formal report of the work of that section. He has even been unable to preside at our meetings during the present session. As the President has designated an hour this evening in which agricultural topics can be considered, the section has desired me to say that the subject it will present to

the general session for debate is topic No. 5 on the program, How can the results of work be most successfuly presented to the farmer?

The CHAIRMAN. Gentlemen, before entering upon the discussion of this topic, permit me to call the attention of the members to the necessity of observing the standing rule of the Association limiting speakers to 10 minutes. This will be necessary in order to cover the ground in the 1 hour allotted to us, so as not to extend the discussion so late into the evening as to interfere with Mr. Warington's lecture. I believe Mr. Roberts is the first speaker.

Mr. ROBERTS. Mr. Chairman and Ladies and Gentlemen: The time allotted, 10 minutes, is entirely too short to allow me to even hint at what should be done in order to reach the farmer, because that is the objective point. If we do not reach the farmer and interest him we fail very largely in our office. I judge it goes without saying that underneath this question, or reading between the lines, we suppose we have something to say to the farmer in which he is or should be interested; so that possibly it is our first duty to find out whether we have anything to say that is of value, for if not we had better be quiet.

Second, we should understand as far as possible who this farmer is, his environments, and conditions. I take it that the American farmer as a rule is a man who in his youth ceased going to school at 14, 16, or 18 years of age, and that nine tenths of our farmers went no further than the district school, while the other tenth, or a large part of it, went to the academy, and one in five hundred or a thousand went to college. Now these are the people with whom we have to deal. They left school and went to their homes upon the farm. There, with but little knowledge and with strong muscles, they worked many hours a day. They did little in the way of studying and many of them did less in reading. In this land to-day there are thousands of farmers who have not a single newspaper in their homes. Now this is the class of men that we are to approach. He knows a good deal notwithstanding all these conditions. If you or I go out to trade horses with him he will get the best of the bargain. Why I have heard that there are farmers' sons so sharp that two of them could trade horses with each other and make $5 apiece. You go out with one of them to judge a sheep or the yield of a field of wheat, and you will find that his judgment is better than that of the professors of agriculture in the various States; it is more likely to be correct. How did he get this information? He did not get a knowledge of the horse by reading Youatt or by going to a veterinary college, and he did not get his knowledge of the wheat field by conducting a thousand experiments on plats. He got his knowledge by comparison, through the eye. That has been his means of education—the comparison of things with one another, and all through the eye. Of many of these things he does not even know the proper names, and yet he is an excellent judge of many things with which we have to do on the farm. So I say that we must approach this farmer, if we are

to approach him at all, through the eye; we must approach him by object lessons, and almost never by abstract reasoning, by which we can do nothing at all with him.

Those who have had the privilege of a liberal education in classical colleges can reason quite as well without the blackboard, the picture, the two lines (one longerth an the other), etc., having a command of language which enables them to choose the right word for the right place and make themselves clear in a word picture. The farmer can not make a word picture, so we must do it for him. Therefore to reach the farmers we must illustrate, using more pictures and less words, more lines of different angles and less figures. I think you will bear me out in the assertion that in order to get a man interested you must attract his attention with something a little novel. Now it may not be very dignified, I will admit, to take a photograph of a pig, old and very lean and an uncouth object, with a man holding on to one end of a rope, the other end of which is attached to the pig's hind leg; but though it may not be dignified, its effect may be powerful. When the farmer opens the bulletin his attention is attracted, and that is what we want, so that he will not throw that bulletin into the waste basket, but will begin to read. So I should say that you can hardly go amiss in illustrating.

Is my time up Mr. Chairman?

The CHAIRMAN. The constitution allows a double ration of time to those who open these discussions. You have 20 minutes, sir.

Mr. ROBERTS. Another thing is this: A man who has been educated in a college where they taught Latin, Greek, and mathematics principally, and where the student all the way through every term had to hold himself down to hour after hour of consecutive mental effort—that man, I say, can pick up a long bulletin, an essay full of abstract reasoning, and feel himself interested. Suppose it is on fruit and he is interested in that, and has had that preliminary training, he will read a hundred pages, figure it all out, arrange it for himself, and be ready to give it to his neighbor. Not so the farmer. He, a busy man, has been used to reading small paragraphs in the paper. So the bulletins must be short. To illustrate that, we have two bulletins in the press, and we are afraid to send out the two in one envelope, although it would be considerably cheaper to do so, saving a good many dollars, so we have decided to send them out in separate envelopes, although ready simultaneously. The idea is that if we send to that poor, tired man, who reads but little and judges everything by the eye, two bulletins at one time, in one envelope, he will probably read neither of them. So I must reach him with just a few leaves. It seems to me that is the way.

Again, I must reach him often. Remember what his avocation is—up at early dawn; work before breakfast; work until dinner; work until night—until 6 o'clock, and at this time of year often until dark. The mail comes home; some one has been to town and brought it back.

He takes up a bulletin that is nearly all solid figures. Now it may be very good, but it is nearly all solid figures, with nothing to break up the monotony of the page. That bulletin is never read. The bulletin must be of such a character that the man who gets it will read it. In the first place it must be respectable, because a farmer likes things that are respectable. The neater it is and the better the paper, the better it will stand up; the more artistic it is in its presswork, the better he will like it. He will pay attention to it. It is just the same with him as it is with the clerk down here at the hotel. You walk up; the clerk looks you over when you ask for a room, and he says, maybe, "You may go in room 999 in the attic." The next man comes in, asks whether he can be accommodated, and is told, "Yes, sir; we have a very fine room down on the lower story." The clerk is entirely unacquainted with the two men. He judges them by outward appearance, and nine times out of ten he judges right. Once in a while, perhaps, he gets a senator up in the attic, but not very often. So you must dress up. If you are going away from home you dress up a little. Dress your bulletin up; it is going away from home. A short time ago I spent nearly all the spare time I had in 2 days deciding whether I should save about $150 by doubling my bulletins over in the wrappers and putting cheap paper around them. I took one of them that has a half-tone print in it. I doubled it up and did it up ready for mailing, and looked at it, and said: "That is a bad expenditure of money; there is that picture that Professor Bailey has taken so much pains with, and I have ruined the whole thing. I will buy 100,000 envelopes and I will not fold that bulletin. I want to have it dressed up so the farmer will see that it is respectable and will think it has come from a respectable place, as it has." All these things have a tendency to interest the farmer.

Now I will inquire as to what kind of thing we shall send him. What shall we send him in order that we may reach him successfully? We must send him a great deal of matter, but the question implies that we are to reach him, attract his attention, teach him, and cause him to act. Are we to send him scientific investigations that are so deep and so abstruse and abstract that he does not know how to bring them together and use them on the farm? Those experiments are probably the most valuable experiments the stations are conducting, but somehow or other we have either got to wait until we lift our audience or until the writers of the bulletins get skill enough to present these facts, that are so difficult to present, but are so valuable, in such a way that the farmer will comprehend and appreciate them. Talking to him in Latin is not of the slightest use, and a great table that is not condensed and that is not thought out for the man is Latin. It is Latin to the average farmer and it is Latin to the average city man, here in this town, in my own town, and in all of your towns. There is only one in ten who can take up a bulletin full of figures not boiled down and not illustrated in some way or other, and understand it. A farmer

is no worse in this respect than a laboring man of any other avocation. They are all busy. Then the bulletin must be so short that when the tired farmer comes in from his work in August, July, or January he can read it even before he gets his hands washed and his supper eaten. There is something about that little visitor—it is an unexpected visitor, and is dressed up so nicely—that attracts his attention, and he has read it before he lets his tea get cold, because there is so little of it; and he understands it, and he sticks it in his pocket, and to-morrow you will find him reading it across the fence to the farmer who is his neighbor. I know of bulletins from several stations that have been reported to me as having been carried in the pocket of the man who first received them until he reached the next farmer, and so on, the bulletins being passed on, and on, and on again until one had been read by 20, 30, or 40 farmers; and back came the postal cards to the stations saying, "Send those bulletins."

One more point, and then I am through. Shall we reach everybody? If we were to take a list of the farmers in the State of New York and send each of them a bulletin, and send one copy also to each of the one thousand seven hundred and odd papers in the State, as we are compelled to do by the law, we would not have money enough to do the publishing and do it well. Fifteen thousand dollars will not send twelve bulletins such as we are now publishing to every farmer and every newspaper, besides the few we send to other States and to foreign countries. Now what are we to do? Why, we must use the press, and the press is glad to be used, and probably it is now no secret that in our first bulletins we got out three sets of cuts, knowing, expecting, that we would have to use the press, and that the newspapers would be glad to serve us if we used them right; and so our cuts have been from Ithaca to California, and to Australia. I think that other stations can say the same. I do not know, but I think they have done the same thing, furnishing the cuts, and in some cases furnishing advance copies of bulletins to any papers applying for them, and telegraphing them when they might let the copies go. We know that our first bulletins reached 600,000 interested readers, and how could that have been without the valuable press? And I think other stations have done as well as we have. Now there are lots of farmers who do not want your bulletins at all; they do not thank you for them; they do not believe in you; you part your hair in the middle and get high salaries, and they propose to go right on in the old-fashioned way. Well, I say, let them go; I am not going to worry about it at all. I do not want to send a bulletin to every man, and would not if I had them to send. Such men must wait until the atmosphere is right, and then they will read For the present "Ephraim is joined to idols; let him alone."

Mr. SCOTT of New Jersey. In the very interesting and emphatic speech with which this discussion has been opened, I think the strongest point made was that the communication should be as direct as possible;

but in all that was said by Mr. Roberts, and I listened carefully, I heard no word as to the personal communication between the farmer and those who are engaged in the work of investigating, and also, I may assume, in the work of instruction, for as I understand it this discussion brings in the college as well as the experiment station. That, it seems to me, is a most valuable part of our work—that personal, hand to hand, eye to eye method of getting at the subject which is interesting to both the investigators and the farmer in common. This, we know, has been begun in various ways by the various stations. I will say but a word in regard to the efforts made in New Jersey. A world of good was done by the late lamented Dr. Cook, who was the director of our station. He did a great work in our State by going from man to man. That work has been continued in his way by those who are appointed professors in the experiment station, and we mean to have it kept up, as it has met with good success; but we propose to have it carried on not only in that individual way, in which the individual strength shall be manifest and bring forth its fruit, but also in a systematic and thoroughly organized way. I have, for example, in looking up this matter in the short time that I have had since I have been particularly connected with these things, sat at the feet of the managers of the Wisconsin school, and have learned very much by so doing. There we have an illustration of personal influence, and work of that sort should be organized everywhere. But I wish to emphasize especially a plan we are at present organizing in New Jersey, which I think will prove of vast value to us and to others who adopt it, namely, university or college extension.

It seems to me that in all the effort that principle is making to organize itself and to do good work, there is no part of it that will be of so considerable value as that which has in view the practical end that agriculture and the kindred arts have. To that end we propose to use a good part, a fair part, of the fund that comes to us by the recent United States grant in employing men not merely as lecturers to talk from the platform, speaking *ex cathedra*, but to go into small groups of men, organize them, bring to them the bulletins and the latest books of practical value to them, showing them the pictures, if you will, and what they all mean, and talking to them then and there, studying their characteristics as a group, and so far as possible those of each man. That, I will admit, is more possible in so compact a State as New Jersey, where, it is said, there is no point on the map where you can put a pin hole more than 7 miles from a railroad. Our State is compact in other ways too: We can easily reach its population of a million and a half, and so far as possible we mean to perfect such an organization in every yart of the State. We have not done it yet, but a year hence I hope to be able to bring you some results; and I would commend to the consideration of this convention personal extension, by organized effort, of the knowledge gained in the schools.

The CHAIRMAN. The subject is still open, but we have only a few moments of time left.

Mr. ALVORD. I would suggest that we pass to the next topic at once.

The CHAIRMAN. The next topic is, The relation of teaching to experimental work, the discussion to be opened by Professor Morrow of Illinois.

Mr. MORROW. I regret to appear before you at this late hour. I may say that the discussion of this topic has been assigned to me, not selected by me, and that I can do very little more than to give a synopsis of the line of thought that occurred to me as I was trying to get at the truth rather than to debate the question with myself. I will read a short paper which I prepared quite hurriedly.

Mr. Morrow read the paper referred to, as follows:

THE RELATION OF TEACHING TO EXPERIMENTAL WORK.

The law establishing the agricultural experiment stations contemplated a close relationship between them and the agricultural colleges. In most cases such relationship has been maintained. Exceptional circumstances may make it undesirable. As a rule intimate relations and cordial coöperation are helpful to both college and station. The ultimate aims of each are much the same. Frequent study of the experiments in progress, and, on occasion, helping in the work must always be helpful to the student. The work in the experiment fields, barns, and laboratories affords some of the best possible object lessons by which to vivify and make enduring the teachings of the lecture room and the text-books. Careful study of the experiments at the station and occasionally helping in planning, conducting, or directing them must be helpful to the teacher in the college. Not alone in religion is "experimental knowledge" best. The teacher who tells only that which he has been taught by others will teach less effectively than the one who speaks or writes of that which he has seen and felt and handled.

Your thought anticipates the admirable illustration at my hand. A chief object of this meeting of our Association is that we may listen to a course of lectures, which we hear with pleasure and profit, not only because they clearly and concisely tell of some of the work done at the most famous agricultural experiment station in the world, but largely because the lecturer has seen much and done much of the work reported. Keeping in mind that the results of his investigations are to be given to others, and, when occasion offers, himself presenting them, not only to other investigators and scientists, but also to the students and the people, by pen and voice, must help the experimenter in his work.

Is it a needless commonplace that the chief object of these Government-endowed experiment stations is not to give investigators an opportunity to pursue their studies, not even to wrest from Nature her secrets for the sake of knowledge itself, but to acquire knowledge for the use of man? Were it practicable the ideal condition would be that in which every teacher should be an experimenter seeking new truth, and every investigator should be the herald and expounder of the results of his own work. This is not practicable because of the limitations of human capacity, which, with the constantly widening fields for investigation and teaching, make a division of labor and specialization of aim more and more necessary. But division of labor may be carried too far. It is a misfortune if the river spreads itself so wide that the boat grounds on the sands, but the results are quite as bad if to secure depth it so narrows itself that the boat is held fast by the banks.

It is a pretty picture, that of the pale-faced, high-browed, fragile-framed scientist, who so earnestly pries into the very heart of nature or is so fired with the desire to

teach the truth that he is oblivious of his wife and forgets his dinner; but neither among the college presidents or station directors have I found this man at the hotel where I stop. With fine scorn we denounce the man who fritters away his time and energies in getting a smattering of many kinds of knowledge, but I have not often met him in either college faculty or station staff. No one of us knows too much in his specialty. All of us have felt that we could do our special work better if we knew more along the lines in which our fellow workers are walking. Here, as generally, in the middle way lies safety. Keep the college and the station side by side in intimate and cordial relations, as two helps to one end. Let the teacher carefully study the experiments now in progress as well as those grown venerable with age, and make much use of them as object lessons. Let there be the freest consultation between the teacher and the experimenter, and so far as it is practicable without injury to his assigned work, let each help and work in the other's field.

Mr. ALVORD. Mr. Chairman, I move, and under the circumstances of the evening I trust that this audience will sustain me, that the discussion be closed, and also the business session of the evening.

The motion was carried.

Mr. Warington then delivered his lecture entitled Nitrification.

At 10 p. m. the convention adjourned until the following afternoon at 2 o'clock.

AFTERNOON SESSION, SATURDAY, AUGUST 15, 1891.

The meeting was called to order by Vice President Roberts at 2 p. m.

The CHAIRMAN. What is the business before the meeting?

Mr. ALVORD. We have established a pretty good machine of six little wheels within one big one, and we want to keep it going right. I would like to make two or three general statements once more, as it is perhaps the last opportunity. As to the representation in the convention, the figures now stand at 124 delegates and attending representatives from 38 States and Territories, representing 42 stations and 38 colleges. Every State in the Union east of the backbone of the continent is represented except Georgia and South Carolina, and this is the first time in the history of our Association that we have been able to make this statement. As to the rest of our program for this meeting, it will be noted that it is proposed that the business of the Association shall be concluded this afternoon, but that nominal general sessions will be held on Monday and Tuesday evenings, in order that the remaining lectures by Mr. Warington may be delivered under the auspices of the Association. Although this is our final business meeting, discussion is provided for on Monday evening upon subjects to be reported by the section on entomology, the reason for this being that the officers of that section have not been able to be in Washington until to-day. Any business which sections desire to report may be reported on Tuesday evening, but only for the information of the general Association. Those are the only remaining points of the program for next week. The executive

committee now proposes, for the guidance of the Association in the economy of time this afternoon, the following program:

(1) The resolutions already offered and referred, to be reported for the action of the Association.

(2) Business to be reported from the several sections by the officers thereof for ratification or rejection by the Association as a whole.

(3) Report of the nominating committee for action thereon.

(4) The nominations by the several sections of their chairmen for the ensuing year.

(5) Final resolutions that may be offered by unanimous consent.

In order to avoid embarrassment, owing to the fact that the section on entomology has not up to this time been able to transact its business as was desired, I will now move that that section be empowered by this Association to nominate its chairman for next year, the rules to be suspended to allow the section to report its action in this regard to the Association next Tuesday evening instead of this evening.

The motion was carried.

The CHAIRMAN. The executive committee will present resolutions.

Mr. ALVORD. The executive committee reports back the resolution offered by Director Roberts of New York, with some verbal amendments, and recommends that it be adopted, as follows:

Resolved, That this Association most respectfully urge the Secretary of Agriculture to do what he can to secure the preservation of public forests and woodlands, by the passage of a law or laws which shall exempt from sale or preëmption Government forest lands now unsold, and cause them to be surveyed, reported upon, and protected.

The resolution was adopted.

Mr. ALVORD. The executive committee reports back the resolution offered by Director Armsby of Pennsylvania, slightly amended, and recommends that it be adopted, as follows:

Resolved, That in the event of receiving suitable propositions for coöperation from the Columbian Dairy Association, the executive committee of this Association be authorized, at its discretion, to appoint three delegates with power to represent the Association and coöperate with similar representatives of the Columbian Dairy Association and of the various organizations of breeders of dairy cattle in formulating rules for the conduct of the proposed tests of dairy breeds at the World's Columbian Exposition.*

The resolution was adopted.

Mr. ALVORD. The executive committee offers to the Association the following resolution, not heretofore introduced, and recommends its adoption:

Resolved, That this convention hereby expresses its satisfaction with the present organization and work of the Office of Experiment Stations in the United States Department of Agriculture, and especially with the progress made upon the indexing of the literature of experimental agriculture.

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*It was found later that the Columbian Dairy Association had requested the appointment of one person instead of three. The executive committee appointed Director M. A. Scovell of Kentucky.

The resolution was adopted.

Mr. ALVORD. We have nothing further, Mr. Chairman.

The CHAIRMAN. We will pass, then, to business other than nominations from the sections. First we will hear from the section on agriculture.

Mr. MORROW. The section on agriculture beg leave to say that in accordance with the recommendation of Assistant Secretary Willits of the Department of Agriculture, it recommends the appointment of a committee to confer with that gentleman in regard to the exhibit of wheat that he is now collecting for the World's Columbian Exposition, in the matter of identification of varieties, and as to all other matters concerning said exhibit, and recommends the appointment on such committee of Messrs. Hunt of Pennsylvania, Roberts of New York, Vanderford of Tennessee, Plumb of Indiana, and Gulley of Arizona.

Mr. ALVORD. I move the acceptance of the report and the adoption of the recommendation.

The motion was carried.

The CHAIRMAN. I presume the chairman or secretary of the section on botany is present.

Mr. HALSTED. The section on botany has no business to report.

The CHAIRMAN. Chemistry.

Mr. NEALE. The section on chemistry has no business to report.

The CHAIRMAN. We have deferred the report of the section on entomology. Is there anyone here to report from the horticultural section? I hear no response. The section on college work.

Mr. STOCKBRIDGE. On behalf of that section I would say that it held three very largely attended and profitable sessions. There are only two matters of business that the section desires to present to the general session. At the first of our three sessions a committee was appointed to confer with the Secretary of the Interior and ascertain the present status of the payment of the third installment, due under the provisions of the Morrill act of August 30, 1890, and further to confer with the Commissioner of Education concerning a circular letter received from him under date of August 13, 1891, and to secure, if possible, a revision of that letter. The committee reported twice, first a report of progress, and second a final report, made this morning, stating first that under the provision for the payment of installments under the Morrill act no statement was made except that it would be paid early in September, and that the delay was not due in any part to causes emanating from the colleges themselves, but arose from certain conditions in the Interior Department. Concerning the second matter—the provisions of the circular letter received from the Commissioner of Education—the committee reported this morning that their interview with the Commissioner had been attended with complete success, and that they were able to present to the convention and Association a form of report for the treasurers and a second form of report to be made by

the president of each of these institutions, these being the two points covered by the communication from the Commissioner of Education. I have these here as adopted by the section on college work, and copies will soon be mailed to all college officials interested.

Mr. ALVORD. We ought to have action upon that now. I move that the recommendation of the section on college work to adopt these forms of report, already approved by the Interior Department, be adopted in the name of the Association. I would like to add to that a proviso that a committee of the section on college work, having this matter in hand, be empowered, in coöperation with the Commissioner of Education, to make any necessary minor modifications of the report before it goes to print.

Mr. STOCKBRIDGE. I second the motion, as it embodies the intention of the section on college work.

The motion was carried.

Mr. STOCKBRIDGE. The second matter is embodied in the following resolution:

Resolved, That the section on college work recommends to the Association that a committee of three on the subject of a collective exhibit at the World's Columbian Exposition on the work of the agricultural colleges, be appointed.

The CHAIRMAN. What shall be done with the balance of the report from the section?

Mr. ALVORD. I move the adoption of this recommendation, with the addition of the words, "with instructions to coöperate with the standing committee of the Association upon station exhibits."

Mr. JORDAN. I move the amendment of that resolution by changing the word agricultural to *industrial*, so that it shall read *industrial* colleges, instead of agricultural.

The motion was seconded.

Mr. PORTER. I think it would be unadvisable to make this change, for the reason that in all our consultations with the Departments we have been endeavoring to conform strictly with the phraseology of the law, and to use the same terms in all our official communications. The term "agricultural college" is so fixed that I believe it is unadvisable to make any change. I believe in retaining the words "agricultural and mechanical colleges."

Mr. MORROW. As bearing upon this question, and following in the line of what Mr. Porter has said, I think it would be helpful to read a letter which Secretary Willits kindly sent to me personally, not having time to present it more formally, from the Chief of the agricultural department of the Exposition, who has introduced the matter, inviting us to make this collective exhibit in that especial way. You will see that he uses the word "agricultural," and gives this particular exhibit a somewhat specific character; and I fear it might lead to some complications as to the particular matter contemplated by this resolution if a change in the phraseology were made. With your permission I will read the letter referred to as bearing upon the subject.

Mr. Morrow read the letter, as follows:

OFFICE OF THE DIRECTOR GENERAL,
WORLD'S COLUMBIAN EXPOSITION,
Chicago, Illinois, July 21, 1891.

SIR: In considering the scope and possibilities of the exhibit in the agricultural building at the World's Columbian Exposition, I have been strongly impressed with the advisability of having in this building an exhibit made by the agricultural colleges of the different States.

To me it seems eminently proper that the agricultural colleges, closely allied as they are and should be to the agricultural interests of our country, depending upon those interests for whatever success is brought to them, should make such an exhibit in the agricultural building of the Exposition as will more closely cement the friendship between the agricultural interests of our country and these colleges, and by this exhibit show to visitors the excellent results obtained by these colleges in the work of giving students practical and scientific education as well as manual training.

I think such an opportunity should not be allowed to pass without being taken advantage of. While it is true that the official classification of the World's Columbian Exposition provides for agricultural colleges, among other institutions of learning, in the department of liberal arts, I feel reasonably sure that if the colleges desire to make their exhibit in the agricultural building, the classification can be arranged satisfactorily.

Will you be kind enough to give me your judgment on this important subject, and if in accord with mine I shall present the matter by letter to the presidents of the different colleges, and see if we can not secure their coöperation in this work?

With assurances of my high regard, I have the honor to be,

Yours very respectfully,

W. I. BUCHANAN,
Chief of the Department of Agriculture.

Hon. EDWIN WILLITS,
Assistant Secretary of Agriculture,
Washington, D. C.

The CHAIRMAN. The pending motion is to substitute the word *industrial* for the word "agricultural."

Mr. JORDAN. I do not wish to in any way upset any plans or do anything that will create a disturbing influence, but I understand that the work of the land grant or industrial colleges in some States is very important along the mechanical lines, and I have supposed—I may be mistaken—that this exhibit is to be an exhibit of the educational work of the land grant colleges. If, however, it is to be merely an exhibit of the agricultural departments of the land grant colleges, there will be no purpose in the amendment I have offered, and I will withdraw it. If it is simply an exhibit of the agricultural relation of the land grant colleges, and has no other meaning, I will withdraw the motion.

Mr. ALVORD. It may be briefly stated, by way of explanation, that the proposition is for any exhibit of the land grant colleges in the agricultural building as a part of the agricultural exhibit at large, the supposition being that it will be the agricultural side of these institutions that will there be put forward; but this need not interfere with any

other or further exhibitions the institutions may wish to put elsewhere. The Chief of the department does not propose to afford room for that purpose.

Mr. JORDAN. I withdraw my motion.

Mr. SCOTT of Ohio. I am not quite sure that it is desirable to have the agricultural colleges, or agricultural and mechanical colleges, divide their exhibit. I am quite in sympathy with the desire to have the agricultural part of the exhibit put where the agricultural people of the country will see it, but it is at least doubtful in my mind whether it is desirable either to exclude the mechanical exhibit altogether or to divide the two. Any one of these institutions I should think would be better satisfied if it could present its whole work in one place and not have a part of it here and a part there, and if we can not put it all in the agricultural building it is at least worth while to consider whether it would not be better to place the whole of it somewhere else. I do not say that would be best, but would simply suggest that we ought to be able to make a combined exhibit if we so desire; and it seems to me that it would be quite unfair for us to take such action here as would prevent the colleges from making an exhibit of their other departments.

Mr. BREWER. I would state here that in the discussion this morning it was intended that this resolution should simply place the matter in the hands of a committee. It is evident that this body can not decide the matter. State laws may interfere in some cases. But if it is practicable to have an agricultural exhibit from the agricultural colleges, it can be placed in the agricultural building and there is the place for it. There is no place for it if it is to be an exhibition of all the departments. This resolution is simply to place the matter in the hands of a committee.

Mr. ALVORD. I move a substitute for the pending resolution, viz.

Resolved, That a committee of three, specially representing the colleges of agriculture and mechanic arts, be appointed to consider the subject of a collective agricultural college exhibit in the agricultural building of the World's Columbian Exposition, with power to represent the interests of the Association in this connection, and with instructions to coöperate with the standing committee of the Association upon station exhibits.

The resolution was adopted.

Mr. SCOTT of New Jersey. As it would be well to have this committee thoroughly representative of the Association, it ought, perhaps, to be appointed by the executive committee. I move that this committee be appointed by the executive committee of the Association.

Mr. MORROW. I take pleasure in seconding that motion. I think there is a little doubt in our minds, and the matter is one of very great importance. The executive committee, it seems to me, can give this matter grave consideration and make the wisest selection.

The motion was carried.

[Subsequent to the adjournment of the convention the executive committee appointed the following-named gentlemen to serve on the

committee called for by the resolution: Messrs. G. W. Atherton of Pennsylvania, J. H. Smart of Indiana, and G. E. Morrow of Illinois.]

Mr. ARMSBY. I have a matter to present. At the time when our committee was appointed it was the understanding that the proposed collective exhibit should be made in the Government building, in connection with the exhibit of the Office of Experiment Stations. Subsequent developments have made it seem desirable to our committee that the exhibit of the stations should be made in the agricultural building of the Exposition rather than in the Government building, and I will state very briefly the reasons for that conclusion, premising that the proposition has the approval of the Assistant Secretary of Agriculture and indeed is recommended by him. The reasons are in brief as follows: In the first place we shall probably be able to secure a greater amount of space in the agricultural building. The total space allotted to the Department of Agriculture is something over 20,000 feet, to be apportioned among the several divisions of the Department. In the second place, if we put this exhibit in the agricultural building we shall be spared the otherwise inevitable comparison between the large exhibits of the Department of Agriculture and the necessarily smaller exhibits of the experiment stations. It is not possible, for example, for the experiment stations to compete with the Division of Chemistry of the Department in the way of exhibits. That Division is a very much larger affair than the chemical laboratories of our stations, whose exhibits would certainly suffer by comparison if the two were brought into juxtaposition. If we go into the agricultural building we shall avoid that, and further, we shall be placed where the visiting farmers can better see what we are exhibiting than they could if we were in the Government building. Finally, it will be extremely desirable that the college and station exhibits be in connection with each other. I will add that we are assured by the Assistant Secretary of Agriculture that there will be no difficulty whatever in the way of having the Department assume a part of the expenses attending the exhibit if held in the agricultural building, just as it would if we exhibited in the Government building. Your committee, therefore, would be glad to be authorized in some way, either alone or in consultation with others, to make this change of location if on further consultation it is decided to be the proper thing.

Mr. JORDAN. It seems to me that the committee should have a large power to act as circumstances may seem to render desirable, and therefore I desire to offer the following resolution:

Resolved, That the question of location of the exhibit of the experiment stations at the World's Columbian Exposition be referred to the standing committee in charge of the preparation of the exhibit, in consultation with the United States Department of Agriculture and the executive committee of this Association, with power to act.

The resolution was adopted.

The CHAIRMAN. Is there any further business, other than nominations, from the section on college work?

Mr. ALVORD. There is nothing further. Next in order will be the nominations of officers by the several sections.

The following nominations were made by the sections, those of the chairmen being confirmed by vote of the Association:

Section on agriculture: Chairman, C. L. Ingersoll of Nebraska; vice chairman, G. W. Curtis of Texas; secretary, T. F. Hunt of Pennsylvania. Section on botany: Chairman, G. F. Atkinson of Alabama; secretary, L. H. Pammel of Iowa. Section on chemistry: Chairman, M. A. Scovell of Kentucky; secretary, H. H. Harrington of Texas. Section on college work: Chairman, E. M. Turner of West Virginia; vice chairman, C. H. Pettee of New Hampshire; secretary, H. E. Stockbridge of North Dakota. Section on entomology: Chairman, L. Bruner of Nebraska; secretary, F. M. Webster of Ohio. Section on horticulture: Chairman, E. A. Popenoe of Kansas; secretary, T. L. Brunk of Maryland.

The CHAIRMAN. Next in order is the report of the committee on nominations of officers of the Association for the ensuing year.

The committee on nominations, through its chairman, Mr. F. A. Gulley of Arizona, presented the following names to the convention:

For president, W. L. Broun of Alabama.

For vice presidents, C. W. Dabney, jr., of Tennessee, J. W. Nicholson of Louisiana, H. E. Stockbridge of North Dakota, F. E. Emery of North Carolina, W. H. Jordan of Maine.

For secretary and treasurer, M. A. Scovell of Kentucky.

For executive committee, H. E. Alvord of Maryland, H. H. Goodell of Massachusetts, J. A. Myers of West Virginia, W. Frear of Pennsylvania, A. T. Neale of Delaware.

On motion of Mr. Brewer the report was adopted, and the Secretary was directed to cast the ballot of the Association for the persons nominated. The Secretary reported that the ballot had been cast, and the Chairman declared the officers duly elected.

The CHAIRMAN. Final resolutions are in order.

Mr. MORROW. I am not prepared to state in the best words a resolution, which I am sure will commend itself to all, but will offer it as I can:

Resolved, That this Association renew its expression of sincere thanks to Sir John Bennet Lawes for his munificent provision for a course of lectures on the work done at Rothamsted, to be delivered biennially in the United States; and it also wishes to express its sincere thanks to Mr. R. Warington for consenting to deliver the first series of lectures, and its appreciation of the high scientific and practical value of the course to which we are having the pleasure of listening.

Mr. BREWER. I second the motion most heartily. I do not wish to say much here, because we have but little time. The lecture which is to follow will be listened to with much more pleasure than anything

I might say, but I know that this resolution will be most heartily agreed to.

By a rising vote the resolution was unanimously adopted.

Mr. BREWER. I wish to offer the following resolution:

Resolved, That the thanks of this Association be extended to the officers of the Columbian University for their generosity in placing this building and its appliances at our service; to the committee of the affiliated scientific societies of Washington, who have done so much to bring about the success enjoyed by our meeting; to the railroad companies which have granted liberal reductions in rates of fare to those attending the convention; and to the local hotels and newspaper press for their hospitality and kindness to us on this occasion.

The resolution was adopted.

The CHAIRMAN. I take pleasure in introducing Hon. W. T. Harris, Commissioner of Education.

Mr. HARRIS, Commissioner of Education. Anybody connected with the Government feels as if the agricultural colleges were, in a certain sense, more closely connected with it than any other educational institutions in the country, with the exception of the military—the Army and Navy institutions at West Point and Annapolis; and we, of course, in thinking out along these lines of education, and of what the agricultural colleges are doing, naturally think of the introduction of the newest methods of education. To come right to my point at once, my Bureau, feeling interested in your work, wishes to get, if it can, details from members of this Association, or rather from presidents of agricultural colleges, showing your lines of work and educational methods. I suppose that you will report to the Department of Agriculture such details as will give that Department the new experiments you make. The Bureau of Education wishes to get the new methods followed in your work. The old-fashioned class-book system—class recitation, in which the pupil is examined, as it were, on what he has prepared himself upon—may be well enough for undergraduates in the colleges, high schools, and lower schools, but it is set aside in what we call real university work, which gets the pupils into a laboratory or a library and sets them to investigating—which is laboratory work—experiments along that line; or seminary work in the direction of hunting up in books, investigating what is known on the subject, and comparing critically all results. Now I know in individual cases from having conversed with members of this honorable assembly, that many of you, scattered all over the country, are making experiments along the line of seeing what can be done in arousing local interest in your work. Your graduates are used as messengers to carry to and fro your interest to various parts of the State. We all know that the agricultural work represents an isolated class of people living on farms; people who do not strike fire by contact with one another, and who are therefore at a disadvantage when they come into contact with an urban population. All urban populations meet socially from day to day, and develop something humane and spiritual, and the farmers ought

to be brought into communion of the same kind. Now in this direction which I am taking the liberty of naming to you—it is an old subject perhaps with most of you—we should like very much to get individual communications, letters, or statements, so that we can print them in our annual report and show the way in which the work from this center—the agricultural college—is done; and I think that is the most desirable center of influence, because it represents the scholastic side—the intelligent, scientific side—of the work of the farmers. It gets hold of their promising young men, and it may organize not only experimental work, but work for the home improvement of the farmer—all sorts of things that will improve his power to grasp the situation.

I do not know but I have said enough for you to see in what line I should like to get information. The Bureau of Education every year undertakes to collect the experience, as it were, of each section, as it were, of the United States, so that each can benefit by the experience of all. We do not believe in centralized power, and do not want any general direction on the part of the central Government, and the Bureau of Education so far as I know has never aspired to be a directive power in that sense—certainly not under my administration; but it does aspire to do what can be done in a country in which local self-government is the principle, that is to collect the experience of all and give it to each. And it is in this line that I take the liberty of mentioning this our wish for an account of your methods of reaching the farmers through your students, in compliance with your kind invitation to meet with you this afternoon. I thank you for your kind attention.

The CHAIRMAN. I would like to ask the Commissioner of Education if there are blanks sent out or questions tabulated, that we may be guided a little in our communications.

Mr. HARRIS, Commissioner of Education. We have not presumed to do that, but if it would be in accordance with your wishes we could get up some tables of questions. The information desired is a little out of the line of ordinary statistical information, and we feel some delicacy in asking questions that may seem impertinent, though I feel that the more we can give which shows methods of work the more useful our report will be.

It was moved that the Commissioner of Education be requested to prepare and send to the colleges for the benefit of agriculture and the mechanic arts circulars containing specific questions to which replies are desired for the information of the Bureau of Education. The motion was carried.

Mr. ALVORD. I move that the business session of the present convention of the Association be now closed, the two remaining sessions of Monday and Tuesday evenings to be devoted to the lectures of Mr. Warington and to such other matters, not requiring the action of the convention, as may be presented.

The motion was carried.

Mr. Warington then delivered his lecture entitled Nitrification and Denitrification.

The convention adjourned until Monday evening at 8 o'clock.

Evening Session, Monday, August 17, 1891.

The meeting was called to order by Vice President Roberts at 8 p. m.

Mr. Alvord. According to the action taken by our Association on Saturday afternoon the business sessions of the present convention are at an end, but the convention has also voted that to accommodate the officers and members of the section on entomology a portion of this evening might be used by them for the presentation of their report. Moreover, the original program adopted by this Association provided for the discussion this evening of subjects coming from that section. This would give the entomologists a double portion. After consultation with the chairman of that section, and with his consent, I make the proposition that we receive his report for the past year and the nominations of the section officers for the year ensuing, and then pass to the lecture by Mr. Warington.

The motion was carried.

Mr. Cook. I have to report that the section on entomology appointed as its officers for next year L. Bruner of Nebraska chairman, and M. F. Webster of Ohio secretary.

The Chairman. What is the pleasure of the convention as to this report?

Mr. Alvord. That was confirmed in advance, sir, by the Association.

Mr. Cook, chairman of the section on entomology, presented the following report:

Report of the Section on Entomology.

Mr. President and Gentlemen: I beg leave to submit the following report from the section on entomology:

Owing to the early date of this meeting, the entomologists can not make as satisfactory a report as they desire, as it is too early in the season to give results, and for this reason not a few withheld their reports altogether. Yet, from expressions all along the line, I can assure you that the work is being vigorously pushed. I believe I can say without fear of contradiction that never before in the history of the country was so much or such good work being done in the direction of applied entomology as is being done to-day.

Of the 44 stations already organized, 35 are equipped for and are doing work in entomology. Six of these employ a man exclusively for station work in this line. In one of these the investigator is employed for only a portion of his time and works exclusively in apiculture, at another a second professor teaches entomology in the college, while in a third the station entomologist will hereafter teach entomology in the college with which the station is connected. Sixteen of the station entomologists teach entomology, and not infrequently general zoölogy and other studies, in the college or university connected with the station. Thirteen of the entomologists have charge of another department of the station also, five of entomology and horticulture, and eight of entomology and botany; seven of these also teach in

the institution where the station is located. Five of the stations are making experiments in apiculture and three have insectaries where insects can be reared under natural conditions and yet be immediately under the observation of the investigator.

It will be seen that in a few stations the entomologist is doing only station work, and that exclusively in entomology; others are doing this and at the same time teaching entomology, and frequently other branches; while not a few are conducting experiments in entomology and either botany or horticulture, and several of these have teaching also added to their duties. That the first method has its advantages, appears in the excellent work done last year in Iowa. That the second is the ideal plan, seems not only to accord with reason, but seems further evident from the fact that so many have adopted this course. That station work and college work can be mutually helpful goes without saying. But if this plan is to bring the best success the professor must have excellent assistants. These assistants must have a salary that will make them content and will secure continued service, at least till others may be educated to take their places. This prevents the shock that comes, of necessity, when an assistant leaves in the middle of the season's work. That this suggestion is wise is shown by the excellent work done at the Illinois Station. In some of the stations the assistant has been called away during the working season each year since the organization of the station. Of course it is gratifying to see our men go to higher places, but such frequent changes are suicidal to the best work of the stations, and every means should be employed to prevent them. The plan of uniting two such broad departments as entomology and botany or entomology and horticulture, although so often followed, seems hardly the wise one. Does not the work done at the Wisconsin Station indicate that it may be wiser to let the workers concentrate their efforts, even if some lines of work are neglected or omitted altogether? Is not quality rather than quantity the object to be aimed at?

In considering the work of the several stations for the year, it must be remembered that the researches are still in progress, so that results can not be fully stated; indeed many station workers because of this and the press of work preferred to send no report.

In Alabama the entomologist also has the work in botany and teaches biology in the college. I have received no report from the station.

Arizona has just organized a department of botany and entomology. The professor will investigate in both these lines and will teach in the university.

California has recently secured an entomologist, who will act for the station and teach in the university. Insects attacking fruit are already receiving energetic attention, but as the work has but just commenced no report can be given.

In Canada the entomologist is also botanist of the station, with no assistant. He very reasonably complains of overwork and unsatisfactory results. Nova Scotia and New Brunswick have suffered from cankerworms, bud moths, and leaf rollers. Cankerworms have attacked apple foliage in Ontario and the ash-leaved maple in Manitoba. *Agrotis turris* has proved to be the most destructive cutworm. It worked in Manitoba, Ontario, and Quebec. At Ottawa it was very destructive, and seemed omnivorous. *Agrotis fennica* has proved very destructive to peas and clover; it feeds on almost all kinds of plants. The wheat bulb worm (*Meromyza americana*) worked not a little on wheat and barley; *Cacœcia cerasivorana* and *Hyphania cunea* were exceptionally abundant, while *Clisiocampa americana* was almost absent.

Colorado organized for work early this year. Experiments will be conducted in apiculture, and the professor will teach biology and apiculture in the college. The special insects of the season—the grape leaf hopper (*Typhlocyba obliqua*), the currant spanworm (*Eufitchia ribearia*), the native currant slug (*Pristiphora grossulariæ*), which is very common and destructive, the pea weevil (*Bruchus pisi*), the tent caterpillar (*Clisiocampa americana*), the cabbage butterfly (*Pieris rapæ*), a flea beetle (*Phyllotreta albionica*), a squash anthomyia (probably a new species) the squash bug (*Anasa tristis*), a bean beetle (*Epilachna corrupta*), a serious beet and potato enemy (*Systena bitæniata*), the gooseberry trypeta (*Trypeta canadensis*), the orchard tortricid

(*Cacœcia argyrospila*), and a box elder tortrix, not yet determined—have all been carefully studied. As many as forty eggs of the pea weevil were found on a single pod, and as many as four larvæ in a single pea. The small grub after eating through the pod wanders over the pea before eating into it. The new *Anthomyia* is a serious enemy of the squash. *Epilachna corrupta* is so destructive that many have entirely abandoned raising beans. *Trypeta canadensis* destroys at least 90 per cent of the currants and gooseberries. The orchard tortricid has been the most serious insect pest of the State. Many plants were entirely defoliated. Those most injured were apple, plum, cherry, gooseberry, rose, and raspberry. The entomologist concludes that Colorado appears to be a rich field for the economic entomologist. The several insects have not only been carefully studied, but experiments have been tried looking to the prevention of injury in the future.

Delaware combines the entomologist and horticulturist in one person, who also teaches in the college. Much time has been given to the dissemination of entomological information by lectures at institutes, granges, etc. Object lessons in destroying insects were made prominent. A new and very destructive corn insect is being worked out. Experiments with the arsenites in destroying the codling moth, plum curculio, and cankerworm are being continued. A careful test with hot water as an insecticide has been made with favorable results, though the kerosene emulsion is preferred. The pyrethro-kerosene emulsion has been used with excellent results. This substance bids fair to take first rank as an insecticide.

In Florida the botanist and entomologist are one. I have no report of his work.

Georgia is doing no work in entomology.

The entomologist in Illinois also teaches entomology and zoölogy in the university. He has several competent assistants, who are paid a good salary, and so are continued in their positions year after year. The station work is so pressing and so incomplete at this early date that no report has been sent to me. Special work in the practical application of bacterial and fungoid germs to destroy insects is being done, and much attention is being devoted to the determination of the life histories of insects. An insectary is included in the station equipment.

Indiana has secured a portion of the services of a professor for station work in entomology, while a second person teaches entomology and horticulture in the college. The following new enemies of the blackberry have been studied: A species of *Coleophora* mines the leaves in April and May. *Blennocampa pauperа* oviposits in buds in April. The larva of *Eccopsis permundana* eats into the fruit in May; the pupal stage lasted 12 days, and the adult came forth May 21. *Anomala binotata* fed on foliage early in May. *Trichius piger*, in company with the rose beetle, ate the blossoms. *Ceresa bubalus* destroyed the tomato plants in the garden in June. In May a species of *Lumbricus* destroyed celery in the hotbeds and in the field. Quite a number of grain insects have been described in a bulletin already published.

Iowa has this year changed her policy. The professor in the college is also station entomologist, with a graduate of the college for an assistant. Insects attacking grasses and clover are receiving special attention. Remedial measures are being tried. It is believed that the hopper-dozer, described in Bulletin No. 13 of the station, will prove very helpful in destroying the locusts and other grass insects. Orchard insects and insecticides are being investigated.

In Kansas the professor of horticulture is also professor of entomology and at the same time entomologist and horticulturist of the station. He is provided with assistants in both departments. I have received no report from him.

Kentucky has up to this time employed an entomologist, who has also been botanist of the station. In future he is also to teach in the college. The following insects are being investigated: Grain insects, with special reference to their life history in the latitude of Kentucky; insects attacking hemp and tobacco (crops much raised in Kentucky); insects peculiar to the season; the completion of the life history of the corn root worm (*Diabrotica 12-punctata*), the eggs having been found in the earth this spring. The life history of the strawberry leaf roller is also

completed and proves it to be three-brooded in Kentucky. It winters in the larval state, pupates toward spring, and appears as an imago in early spring. Insecticides have been used on various species of plant lice and also on plants, to determine proper and safe strength to be used. The arsenites are a specific for the rose slug, but must be kept from the blossoms. The horn fly, which has this season been common in Kentucky, is easily controlled by use of buhach, tobacco dust, or train oil, or better, by a mixture of one of the powders and the oil.

Louisiana combines the entomologist and horticulturist. Investigations regarding the screw worm have been made. I have no report regarding the progress of their work.

In Maine the entomological work of the station is done by the entomologist of the college, who is really professor of biology. Work is being pushed in economic entomology, but no report has been received.

Maryland reports that no work is being done in entomology.

Massachusetts employs one professor for both the college and the station. He has an insectary, of which he speaks in the highest terms. By use of this he is able to determine the entire life history of an insect, which otherwise would be difficult or impossible. Many have been determined, which often verify the work of others, but in some cases differ strikingly from published accounts. In compliance with a demand for information regarding the most common pests, histories of several have already been published, and those of others are in progress. This is not a compilation, but the result of actual personal observation, even though the facts are well known. In Bulletin No. 12 of the Massachusetts Hatch Station the complete history of the bud moth (*Tinetocera ocellana*) is given, correcting many misleading errors of European entomologists regarding this insect. Very elaborate experiments have been tried with Paris green on apple trees in the insectary. Half of the trees were kept in a dry, cool atmosphere; the others in a hot, damp one. Half of each lot were sprinkled from above, *a la* nature; the others were watered by wetting the earth beneath in which they grew. One pound of Paris green to 130 gallons of water was the strength used. The foliage on all the trees in the hot, damp atmosphere were equally and badly scorched, while the others were hardly injured at all. The showers from above seemed in no way to modify the effects of the poison. Experiments were also tried to determine the amount of poison necessary to kill insects. The tent caterpillar (*Clisiocampa americana*) was the insect treated. The poison was used at the rate of 1 pound to 50 to 100, 150, 200, 300, 400, 500, 600, 700, 800, 900, and 1,000 gallons of water, respectively, at the time of each of the several molts. The age of the larva seemed to make no difference. Every strength of the poison was fatal to the insects, though the more dilute applications did not take effect at once. One pound to 300 gallons of water killed as effectually as did the stronger mixtures, and this is the strength the station will recommend in future. The experiments were tried in cages in the insectary, where the insects could not wander from the sprayed branches, and where all could be watched. Cranberry insects are receiving careful study. The entomologist of the station has also had in charge the expenditure of the $100,000 appropriated by the legislature during the past 2 years for the extermination of the Gypsy moth. The work is in very competent hands, and is being pushed most vigorously.

In Michigan the entomologist has charge of all the experiments, including those of the apiary. He also teaches entomology and zoölogy to large classes in the college. An assistant is provided in each department These, however, are only kept till they become efficient, when some other State calls them away, which is ruinous to the best interests of the station. The entomologist is virtually State entomologist, and often receives as many as twenty letters a day inquring about insects. It is also his duty to lecture before the annual institutes and other State agricultural associations. Experiments have been made to determine the value of the arsenites in fighting the plum curculia. Three separate orchards were treated. One pound of

London purple to 200 gallons of water was used. The application was repeated every 10 days and after every heavy rain. The conclusions agree with those of last year. "The ravages are surely lessened and the insects are poisoned." But if the insects are numerous and the crop light, all the plums may and usually will be stung. We are now positive on these points. We inclosed with cheese cloth six small trees after jarring off all the curculio, picking off all stung plumbs, and spraying one half of the trees with London purple (1 pound to 200 gallons of water). We then put the same number of curculios within the inclosure of each pair of trees. After a week the cloth was removed, the curculios caught, and the stung plums counted. In every case live curculios were caught and stung plums were found, but in every case more were found on the unsprayed trees, and many dead curculios were found, but none except on sprayed trees. I will give one case in detail which was about an average. Each tree had sixty unstung plums, and twelve curculios were placed within the cover on each tree. Twelve plums were stung on the sprayed and twenty-five on the unsprayed trees. Eight curculios were found on each tree at the examination the close of the week, four of which on the sprayed trees were dead. Experiments on peach trees showed that London purple, 1 pound to 200 gallons of water, applied every 10 days, did serious injury. With limewater from thoroughly slaked lime, same proportion, no perceptible injury was done; with Bordeaux mixture, very little. I believe that London purple, 1 pound to 300 gallons of limewater, is entirely safe on the peach. This discovery of Professor Gillette of the value of limewater is a very valuable one. In preparing Bordeaux mixture or limewater great care should be taken to thoroughly slake the lime, else it injures the foliage very seriously.

Experiments seemed to show that both London purple and kerosene emulsion were much more injurious to trees suffering from attack of *Aphides*.

A very large series of experiments were made to determine the maximum strength of kerosene emulsion. Safe on all foliage. A one-fifteenth hard soap emulsion did no harm in any case. The same strength with soft soap did some harm. As this never occurred before in our experience it shows that there is quality in soft soap.

The pyrethro-kerosene emulsion, first recommended by Professor Menke of the Arkansas Station, while more effective than the simple emulsion, was found less injurious to foliage. A one-twelfth emulsion proved safe in every case.

Many experiments were made with London purple to find the minimum strength fatal to all mandibulate insects. The experiments were made on bees, potato beetles (grubs and imagos), two species of oak caterpillars (*Anisota*), and on the cabbage caterpillars. The insects were confined in cages in the laboratory on the sprayed foliage and on branches of trees covered with cheese cloth. The several strengths ranged from 1 pound to 100 to 1 pound to 500 gallons of water. One pound to 200 gallons of water always killed within 36 hours, and usually all the insects died in less than 24 hours. A 300 mixture often kills, but it is tardy and uncertain. Still weaker mixtures were only partially effective. The older larvæ are not so easily poisoned as the younger. Thus our previous experiments, made some years ago, agree with these in fixing 1 pound to 200 gallons of water as the proper strength for all applications except on the peach.

The life history of the terribly destructive peach twig moth was partially determined. Many other species have been studied and many parasites reared. The bud moths and leaf rollers were unusually common and destructive, as were the aphides.

In Minnesota the entomologist is also botanist of the station and professor in the university. Extensive investigations are in progress regarding the locusts, but the early date of our meeting makes a report impossible.

Mississippi asks her entomologist to do work in mycology and horticulture, and to teach in the college. Experiments have been made with the screw worm (*Compsomyia macellaria*). The natural food of the insect seems to be dead flesh and ordure. This

suggests burning all organic refuse about slaughterhouses. The insects of the season are being studied. Powdered tobacco is found to be a remedy for the ravages of the cucumber beetle. Kerosene emulsion made by either of the formulas recommended is effective and excellent. *Ægeria pyri* is very destructive to the apple, but not at all to the pear. The borers found at any time in the trees vary greatly in size. Washing the trees in winter with kerosene oil kills the borers. Both of the common lady-bird beetles, *Megilla maculata* and *Hippodomia convergens*, feed on cabbage leaves and do much damage. Other insects are being studied experimentally, especially the chinch bug.

Missouri has no special entomologist, but the professor of horticulture makes experiments in this line. He has a very competent assistant, who resides away from the station. This assistant has prepared and published a valuable Outline of Entomology. The arsenites have been thoroughly tried, and while they are a great success in fighting the codling moth and leaf-eating species, they are of doubtful benefit in combating the plum curculio. Paris green is preferred to London purple as more sure and less injurious to foliage. It should always be mixed with lime-water. Many insects are received from farmers, etc., and are always named and advice given. The full life history of many species previously known only as imagos has been determined. Experiments are being tried with insecticides, especially in the use of fungoid germs to destroy insects.

Nebraska employs a special entomologist with no other duties beyond station work. Insects attacking sugar beets are still under investigation, as are the special insects of this year. A monograph of the *Aphidæ* of the State has been prepared at the station, which gives the food plants of each species.

Nevada requires the entomologist to experiment in botany and teach biology in the college. A list giving the insect fauna of Nevada is in progress. The life history of several species has been determined, with illustrations of the different stages. Investigations are being conducted in the use of insecticides, and special study has been given to the oviposition of the codling moth and the time it takes the eggs of this insect to hatch.

New Hampshire has just organized for work in entomology. The entomologist is professor of zoölogy in the college. His duties in the college have employed his entire time during the past season.

The entomologist of the New Jersey Station is also professor of entomology in Rutger's College. He is making extensive experiments in the use of insecticides. A very thorough study of the rose chafer (*Macrodactylus subspinosus*) has been made and the results published. The squash borer and cranberry insects are receiving special attention. A study of fertilizers and methods of cultivation in relation to insect ravages is in progress. Much time and energy have been expended lecturing at institutes, clubs, etc., on economic entomology. Twenty lectures have been given to farmers in a free course at the college.

Entomology at the New Mexico Station is already well organized and is in charge of the professor of entomology of the college. The vine leaf hopper (*Typlocyba vitis*) has been studied in all stages. Several remedies have been tried, the Riley-Hubbard kerosene emulsion proving the best. The grape flea beetle is very common and destructive, and succumbs to the well-known remedy, Paris green, 1 pound to 175 gallons of water. The following insects are being studied in the field: Peach borer, peach aphis, plum aphis, oyster-shell and scurvy bark lice, tent caterpillar, and green June beetle (*Allorhina nitida*). The latter eats into the fruit. The codling moth has not been observed. A study has been made of the following garden insects: Squash bug, harlequin cabbage bug, cabbage aphis, bean epilonchna, cucumber beetle, and *Diabrotica 12-punctata*, and methods looking to their extermination have been adopted. The indigenous insects destructive to shrubs and trees are being investigated. The department is being well equipped with apparatus and books, and will soon be in excellent condition for the best work.

The entomologist of the New York (Cornell) Station also teaches in the university, where large classes absorb much of his time and energy. The insectary, the first built in this country, gives great satisfaction. Special attention is being devoted to wireworms and milipedes. Very elaborate experiments with insecticides are in progress.

Neither North Carolina nor North Dakota are organized for entomological work.

The entomological work at the Ohio Station has been somewhat checked by the resignation of the entomologist. A new man is on the ground, and the work will soon be conducted with the usual energy. Herctofore the entomologist has also been the station botanist. In future he will have only entomology. The university is separate from the station. Entomology is taught by the professor of zoölogy.

At the Oregon Station the professor of entomology teaches in the college and works in the station. Experiments have been made with the arsenites, mixed with a fungicide composed of whale oil soap and sulphite of soda. Paris green is preferred to London purple, and seems more effective when used with a fungicide. While the latter protects against fungoid diseases, the same treatment destroys the woolly aphis, which is a serious pest in Oregon. A 160-gallon galvanized iron tank, with a heater underneath, and so made that it can be easily moved from a stove or furnace to a wagon, has been used with much satisfaction. The heater makes it possible to keep the insecticide hot while it is being used. The Bean pump, with cyclone nozzle and Vermorel attachment, gives best satisfaction. It takes about 1.5 gallons of the above liquid to treat one tree, which is done at a cost of 7.5 cents. The Pacific coast peach borer (*Sannina pacifica*) is successfully combated by use of the carbolic acid and soap mixture, by the resin compound (full strength) or by wrapping the tree trunk with paper. *Monoxia guttulata* is a serious beet pest. No remedy as yet has succeeded against it. Grain insects are very destructive, but have been easily exterminated by use of bisulphide of carbon as directed in Bulletin No. 58 of the Michigan Station. Kerosene emulsion has proved an excellent repellent of vermin in poultry houses. The hop louse, now a terrible pest in Oregon, is being carefully studied. Tobacco decoction, 1 pound to 2.5 gallons of water proves effective against the flea beetle (*Phyllotreta descipiens*). Cutworms are very destructive. The poison clover traps have been tried against them with unsatisfactory success. Salt has no effect to prevent their ravages. Wireworms are a serious pest, and several attempts to prevent their ravages have been fruitless. The Hessian fly, reported to be in California, has not been found in Oregon. Ducks are said to be killed by eating the bug *Sargus succinctus*, but efforts to get poultry to eat these bugs were an entire failure. Paris green, 1 pound to 250 gallons of water, is found strong enough for the first application against the codling moth caterpillar, and 1 pound to 300 gallons for all subsequent applications. Unless soap and soda are used the last proportion is as strong as the foliage can bear, even for first treatment. Lectures and laboratory practice were given to four students during the past term.

The Rhode Island Station although doing nothing in general entomology, is conducting experiments in apiculture, which are in charge of a well-informed, practical bee keeper.

The South Carolina Station is at present giving no attention to entomology.

At the South Dakota Station the entomologist does duty both in the college and the station. Dipterous insects, insects that attack shade trees, and the insects peculiar to the season are all receiving special study.

At the Tennessee Station the entomologist also teaches in the university. I have no report of either the station or university work.

At the Utah Station the horticulturist is to teach in the college and to take charge of investigations in entomology. No report has been received from that station.

In Vermont the biologist in the university conducts experiments in entomology for the station. This season's investigations relate to the history of the May beetle (*Lochnosterna fusca*) and ways to prevent its ravages.

The Virginia Station unites its entomologist and botanist in the same person. The work reported consists of lectures before farmers' organizations and investi-

gations of insects affecting tobacco. Complaint is made that the work is so heavy that original research is quite impossible.

In West Virginia the entomologist works only in the station and only in entomology. His duties consist of journeys of investigation through the State and lectures on economic entomology before farmers' organizations. The subjects under investigation are, causes of death of spruce trees, insects infesting the locust tree, imported fruit bark beetle (*Scolytus rugulosus*) and its natural enemies, and a study of the family Scolytidæ and the parasites attacking these beetles. Original drawings are made illustrating the species in their several stages. Three thousand and six numbers have been added to the accessions, which include nearly as many species and about 10,000 specimens. A large number of Ichneumon and Chalcid parasites have been bred from the various species of Buprestidæ, Cerambecedæ, and Scolytidæ, which have been studied. Parasitic and predaceous insects found destroying borers in the spruce are thought to be the only hope of salvation for these trees. Three species of parasites were bred from pupæ found in the burrows of *Agrilus ruficollis* which have materially checked the ravages of that Buprestid. Four bulletins, of 30,000 copies each, have been issued.

The Wisconsin Station has organized no department of entomology.

The Wyoming Station has just appointed a professor of entomology in the university, who will also do duty as station entomologist. The department is being well equipped.

Owing to illness and great press of work there is no report from the Department of Agriculture, and so, while I can not speak of their special work, I can speak in the highest terms of their excellent reference collection; of their vigilance in keeping informed of all insect outbreaks and sending special and competent agents to investigate them; and especially of their ever manifest readiness to help us all by advice, by determinations, and by any kind of assistance desired, which is always promptly rendered. In all this they are doing a work of incalculable value, and have richly earned the gratitude and support of us all. Their publication Insect Life is a most excellent and a most helpful contribution toward entomological advancement.

It will be seen by this imperfect report that results at different stations are widely different. This emphasizes the importance of numerous workers and numerous repetitions of experiments not only by each worker but by all the workers.

A. J. Cook,
Chairman.

Mr. Warington then delivered his lecture entitled Nitrification of Soils and Manures.

At 9:30 p. m. the convention adjourned until the following evening at 8 o'clock.

Evening Session, Tuesday, August 18, 1891.

The meeting was called to order by Vice President Porter at 8 p. m.

Mr. Warington delivered his lecture entitled Drainage and Well Waters.

Mr. Alvord. We have just listened to the last of a series of six most interesting and instructive lectures, begun and continued under the auspices of the Association of American Agricultural Colleges and Experiment Stations. It has fortunately occurred that a number of other scientific bodies have successively contributed to the audiences gathered here night after night. The circumstances under which these lectures have been delivered have made it inevitable that there should

be more or less change in the personnel of the audiences during the week. The lecturer has had before him, therefore, not only the delegates to the convention of the Association which especially invited him to be here during this time, but also representatives of the Association of Official Agricultural Chemists; other chemical, botanical, and entomological societies and clubs; the Society for the Promotion of Agricultural Science; and finally, this evening, the American Association for the Advancement of Science, of which, I am glad to say, our lecturer himself is now a member. Under these circumstances it seems to me that we must all agree that the occasion has been a happy one for the delivery of this first course of lectures under the Rothamsted trust.

We can hardly conceive of circumstances other than these under which the lecturer could have addressed in successive evenings, as he has done here, representative men, engaged in active scientific work, from at least forty different States and Territories, besides the District of Columbia and Canada. I think therefore that the arrangements under which this first course of lectures has been delivered here in Washington have certainly been amply justified; and while the Association of American Agricultural Colleges and Experiment Stations has already taken appropriate action in regard to these lectures, it seems to me that it would be a mistake for the gathering this evening to disperse without broadening the recognition of the lectures and of the services of the lecturer himself; and so, as a resident of this vicinity and as a member of the general local committee representing these affiliated societies, on their behalf, and I think I may add on behalf of the residents of Washington and vicinity, who have also contributed to the audiences, I beg leave to move that the thanks of those represented by the audiences gathered here night after night be again extended to Sir John Bennet Lawes and to his most faithful and accomplished representative, Mr. R. Warington, for the lectures here delivered, and I move that the vote upon this motion be now taken and by rising.

Mr. Brewer. I second the motion, and in doing so wish to most heartily indorse what has been said. Thirty-four years ago I left Paris to go to Harpenden and it was 2 days before I got there. Some of the experiments detailed here had then been going on for some time. The patience, accuracy, and care which have marked the steps there taken have been such that to-day the success of Rothamsted presents such an example for us that I am especially happy that these lectures should have been delivered where so many who are connected with experiment stations in this country could hear them. With a pressure behind us here by people who wish immediate results and in the hurry on the part of many who are doing the work, I am doubly happy that we have had this course of lectures, representing as they do such a long, accurate, and careful investigation.

The motion was unanimously carried by a rising vote.

At 9 p. m. the convention finally adjourned.

APPENDIX.

MINUTES OF THE SECTIONS.

SECTION ON AGRICULTURE.

MORNING SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order at 9 a. m. by Vice Chairman Morrow.

On motion of Mr. Lupton topic No. 10 on the program—What should be the duties of the station agriculturist?—was first taken up for discussion.

Mr. Broun stated that in his college the station agriculturist was also professor of agriculture and that a part of his work was the conduct of coöperative field experiments which were being carried on by thirty or forty farmers throughout the State.

Mr. Ingersoll thought the agriculturist must be a teacher, an investigator, and a popular exponent.

Mr. Smith asked for a definite outline of the special duties of the agriculturist.

Mr. Buckham referred to the fact that station farms are expected to be in some degree model farms, and that the conduct of such a farm must be part of the work of the agriculturist. He referred to the importance of the station agriculturist coming into contact with the best farmers of the country, and the necessity for accuracy in work and in expression, as farmers are quick to detect any carelessness in these respects.

The Chairman at this point called attention to the fact that the discussion was developing three principal lines of duty or relationship which should be considered, (1) duty to fellow workers and director, (2) duty as superintendent of model farm, (3) duty to farmers of the State.

Mr. Roberts believed that the work of the agriculturist must be largely decided by circumstances, and stated that the agriculturist of his station was expected to perform any kind of work, whether in the office or the field, that might be required. He wished to emphasize the point that any station worker should be willing to do anything that needs to be done, whether it happens to lie in his specialty or not.

Mr. Curtis believed that the work of the agriculturist must depend largely upon the man himself and his special tastes and aptitude.

Mr. Jordan insisted that the director must be first and that other workers must carry out his policy.

Mr. Porter urged the importance of continuity of plan. The work should be so organized that it would neither be stopped nor diverted from its course by changes in the personnel of the station staff, from director down. He also insisted that the work of experimentation was enough for one man, and that he should not be required to teach also.

Mr. Alvord suggested that the governing board should adjust the work to the personnel of the station.

Mr. Armsby insisted that the director should be the autocrat of the station; that the governing board should select a man on whom they could lay this responsibility, and that then he should have the widest liberty in the choice and direction of associates. He believed that a wise director in selecting his associates would assign different lines of work to men who had made special study of those lines, and then giving them the widest liberty consistent with a proper coördination of the station's work as a whole.

Mr. Dabney believed that many stations were suffering from too much organization. There were too many committees and advisory councils—too many wheels working within wheels.

Mr. Mills urged that greater attention be paid to continuity of plan, and that greater care be exercised in the publication of results, as crudely prepared work was sure to be eventually detected by the farmer and to react against the station.

Messrs. Emery and Phelps spoke from the standpoint of the agriculturist, and urged that the largest liberty in details consistent with proper coördination of work be accorded to him.

Mr. Plumb believed that the term "agriculturist" is a misnomer; that the work now covered by this office should be further specialized, as few men could be found who were competent to do the best work in each of the fields of cereal culture, live-stock husbandry, and dairying.

Mr. Lazenby supported this view.

Mr. Armsby thought that a greater specialization of stations would be found necessary, as no one station could cover the entire field of agricultural research with present income.

Mr. Myers suggested that the duties of the agriculturist were too ill-defined, but as most stations are at present organized the agriculturist must help everywhere.

A number of delegates having come in during the discussion, it was now proposed to take up the program. The first topic was indefinitely postponed. Topic 2 was postponed until Mr. Gulley should arrive, it being understood that he was on the way. Topic 3 was assigned for the first discussion of the afternoon session. Topic 11 was postponed until the following week, as Mr. Hilgard had written that he would be present then. On motion of Mr. Phelps, topic 7 was taken up and opened by Mr. Whitney in the following paper:

Soil Features that Should be Recognized in all Plat Work.

When a boy on the farm I used to hear, and read in the agricultural journals a great deal about the raising of wheat and clover, the value of grasses and stock for the farm, and the improvement of soils by manures and cultivation. The soil of the farm where I lived was a light, sandy loam, near a river, well suited to peaches, melons, and truck, but quite unsuited to the crops first named. Not knowing that there were different kinds of soils, I was distressed that these crops could not be grown, perplexed at the conflicting advice as to how to grow them, and distressed when the most approved methods did not succeed in making them grow. Even when I noticed that my neighbors who raised wheat and clover had stiff clay lands I could not realize, as is doubtless the case with many to-day, that this was due to the difference in the soils alone; that I could not hope or expect to profit by their experience, or raise their crops, or bring the light soil up in an economic manner so as to compete with them in the crops they grew. It took me still longer to realize that there were crops, and paying crops, to which these soils are far better adapted than are the stiff lands. Later experience and research have confirmed this and shown the reason for it, and it would be well to have this recognized and understood by every farmer and farmer's son; and how much more necessary is it to be recognized by one who carries on plat experiments.

It must be recognized that soils differ in texture according to the conditions under which they were formed; that this difference in texture varies the rate with which water will circulate in the soil and the rate with which it will be supplied to the plant and replace loss from evaporation. It must be recognized that certain crops are well adapted to certain soils, because under ordinary meteorological conditions the soil is able to supply soil moisture at a mean rate required for the crop. From the texture and arrangement the soil may be inclined to be too wet or too dry for the best development of other crops, and to secure such development manure must be used for the soil and not for the crop. If the results of the work are to be of general interest the soil selected should represent fairly well a considerable area, and if possible the texture of the soil be shown by the mechanical analysis. It is not sufficient to describe the soil as a "dark loam" or "light sand." Give the geological formation to which it belongs as carefully as possible, and such other information as to extent, quality, texture, and agricultural character as may enable a reader to form an intelligent idea of the experiment and of the extent and value of the application of the results. I have seen several elaborate investigations laid out on land which was afterwards found to be of purely local extent. The selection of representative soil, of uniform texture and fertility throughout, is probably the most difficult, as it is certainly of the first importance, in plat experiments. Then it must be recognized that it is not the plant which is to be asked whether it would like potash, or lime, or nitrogen, but that it is the soil which needs to be changed. For the evidence of irrigation and of the changing seasons leaves no doubt that with the proper water supply any soil will be well adapted to any crop. I have shown elsewhere the remarkable effect fertilizers have on the rate of circulation of water in the soil. We need go only a step farther to show the necessity of absolute uniformity in the physical treatment of the soil.

There is great meaning in Wagner's observation, that the effect of a footstep on his plats can be seen through a season's growth. The compression changes the structure of the soil and changes the relation to water and to plant growth—an end which it is desired to reach by the use of fertilizers alone. From my microscopic work and the experience in working with soils in glass tubes, I can hardly see how it is possible to secure uniform physical conditions in the field, for in glass tubes a slight difference in treatment may give results out of all proportion to the difference in treatment. The most valuable record that could be given in plat experiments would be a record of the moisture in the soil of several plats and a method to secure such a record is much desired.

Afternoon Session, Thursday August 13, 1891.

Mr. Henry of Wisconsin read the following paper:

Physical Conditions Surrounding Animals in Experimental Feeding, Especially as Relative to Stalls and Mangers.

In discussing this subject I shall hold to practices and ideas as they have crystallized from actual experience.

In feeding steers I do not believe in the practice, quite common in the East, of tying up each animal separately or confining them in stanchions, since it is almost impossible to keep steers clean that are thus confined, and I doubt if they do as well as if given more freedom. The Western farmer long ago broke away from this custom and found better results in feeding in the open lot, and better still in the open shed. Were I feeding in Kentucky or Missouri I would rather use a wood lot for feeding purposes than most of the stables found on the better class of farms in the Northern States.

In Wisconsin, where the thermometer sometimes drops to 30° below zero, I think a small lot with an open shed on one side, in which the food is placed, provided with some litter, proves the most satisfactory feeding pen that can be devised. Each steer can be fed separately, but all run together at all other times. Of course cattle kept in this way should be dehorned. Experience has shown that there is no more need of the steer's bringing his horns into the feeding pen than for a citizen of a well-regulated Christian community going around with arms and dirk knives. A bunch of dehorned steers in a small lot with a covered shed at one side, can be handled at a less expense, are free to take the most comfort possible without worry from any source, and are in just that condition that will permit them to make the best possible gains from the food consumed. I know that in making these statements I shall traverse the ideas of some of the Eastern feeders, who may rightfully claim many more years experience than I have had in the matter, but I believe that the feeders in the great corn belt of the West understand the management of cattle far better than their Eastern brothers, and that we had better look to them for advanced methods rather than to the Eastern farmer.

We usually confine sheep in bunches of five each. The troughs in which grain is fed should have the bottom board not less than 10 inches in width and flaring sides about 2 inches high. The grain or concentrated food should be spread thinly over the surface of this trough so that the animal gathers up the grain with its lips, getting but a small amount at a time, which tends somewhat towards better mastication. In fattening experiments the feeder should not place all the grain in the trough at once, but rather a little at a time, watching the way the animal feeds. As the sheep become satisfied they fall back from the trough one by one, leaving a little food uneaten, which should be removed at once from the trough by tipping it up endwise, sliding all that remains back into a basket. If this feed is at once mixed with that in the feed bin the animals will not object to it at the next feeding time. As soon as the sheep are through feeding the trough should be placed out of the way so that the animals can not get their feet into it or foul it before the next feeding time.

The genuine shepherd delights to stand by and watch his sheep eat their grain, and I do not believe his work should press so much as to prevent him doing so, for there is no better time to study the conditions and needs of his animals than this. Where sheep are fed care must be taken to keep the temperature down. They will stand much cold and thrive, but warm quarters are sure death to them. We have a small lot back of each pen, and in fine weather they are allowed to run in this yard for exercise.

In our hog house the feeding rooms are separate from the sleeping compartments, and the hogs are only allowed to come into them at feeding time. By this arrange-

ment there is the minimum of unpleasant odors about the feeding trough, and I believe the pigs are better satisfied with their food than when the trough is in close proximity to their sleeping places.

With us metal troughs are too good conductors of heat for winter use. I believe there is nothing better than the common wooden V trough, made by spiking a 2 by 10 plank at right angles with a 2 by 12 plank. Over such a trough hangs a swing door. There is no place where food can spill out or waste except at the ends of the trough, and there need be little or no loss there if a strip is nailed so as to close the crack and prevent food dropping down where the pigs can not reach it.

Only in winter are any of our pigs kept in or near the hog house. Experience has shown us that there is no better place for swine than a good open pasture lot. In this pasture lot we confine the animals, when necessary, in pens about 2 rods square, made with movable fence panels. These lots are arranged on each side of a narrow lane, which is closed at the lower end by scales for weighing the animals. Over the scales is a temporary shed to keep off rain. In each lot is a shed to protect the animals from sun and rain. At the entrance to the lane is a house 8 by 10 feet square, in which feed and scales for weighing it are kept. Water is carried from the hydrant in the pasture to the feeding pens by barrels on wheels. A group of five or six animals are kept in each pen.

I believe that in all feeding experiments we should feed each animal by itself. We have adopted this practice with pigs and cows, and I hope to follow it up with other animals in the future. With pigs the matter is very simple. In each lot next to the narrow lane above mentioned, is a system of stalls made of light fencing 4 inches wide and 6 feet long. In the front of these stalls runs a trough, divided so as to hold the feed for each pig separately. At the rear is a sliding door. The feeder places each hog's portion in the proper trough, then opens the doors into the stalls, letting one pig into each. After feeding, the pigs are let out and have the lot in common. Even hogs are gregarious animals, and I believe as far as possible they should run together in groups.

As soon as the lots become foul, which is usually in about 3 weeks, everything is moved to fresh sod. A wagon load of coal ashes is distributed in the lots each time we move, and it is surprising to see how eager the animals are for it. We have followed this system long enough now to warrant the assertion that it is a good one.

In arranging the buildings in which experimental animals are kept, I believe much attention should be given to the exposure. While we have cold winters in Wisconsin, there are a surprising number of bright, sunny days when the rays of sunlight afford much warmth if only the cold air can be kept out and the sunlight be allowed to pour in through windows. We now plan our buildings to run east and west, with the feeding alley on the north side and the experimental pens on the south side of the building, with low windows which will allow the winter's sun to pour in its full strength and strike the animal whether standing or lying. The windows should be hung with hinges or made to slide and should be protected from breakage by the animals on the inside with quarter inch iron rods and on the outside by heavy wire netting. In experiments where some of the animals are on the north side of the building and others on the south side in the sunshine, I do not believe the conditions of the test are equal.

In closing I desire to enter an earnest plea for a more careful study of suitable environments and intelligent attendance upon all animals in our charge for experimental purposes. We have approached the exceedingly difficult problem of animal experimentation from the chemical side, and our solicitude for accuracy and the study of better methods of laboratory work has, I fear, often prevented us from properly appreciating the physical difficulties of the problem. Do we not altogether too much regard our animals as retorts or stills into which certain feed substances may be placed and out of which certain things must come with the same exactness and definiteness as in the chemical combinations of the laboratory? In arranging feeding experiments we begin the list of expenses with the salaries of the

chemist and laboratory assistants and the cost of the paraphernalia of the laboratory, and by the time we have come down to the items of the animals to be experimented on, the attendants, and the barn equipments our resources are apt to be so exhausted that but meager facilities and second-rate conditions are possible. If I can have but one side well equipped, give me the best of barns, stock, and food, and the most skillful observing attendants, and let the chemists be more poorly paid, let the laboratory be smaller and have less apparatus.

I believe we should take especial care in selecting the man to whom we intrust the keep of the animals under experimentation. He should have a strong love for animals of the class he is dealing with, backed up by just as much experience and training as possible. The best men, judging from our limited experience, come to us with a natural love of animal life, and will be trained by us at the station. The work is so peculiar and so different from ordinary stock management that I think we will not find our help satisfactory when brought from the ordinary large stock farm. For example, I have had two Scotchmen, highly recommended as shepherds, both faithful and well-meaning, but they could not comprehend or did not have patience to properly carry on experimental work. After dropping these we took up a German, who had no other qualifications aside from good habits, good judgment, and a strong natural love for animals, coupled with a willingness to do as directed in all matters. With these qualifications we are developing him into a first-class shepherd, and in a year or two more we will have a splendid man for a most difficult place.

We should not forget accomodations for the attendants. There should be in each experimental feeding barn a comfortable room, so equipped that the attendant can remain there night after night if necessary. Nor should the skilled attendant be overworked. No man on the station farm carries more responsibility, and reponsibility if well carried calls for a reasonable amount of time in which to accomplish the required work. These men must observe all details carefully and often act quickly. If they are in one eternal grind they can not do so.

Each animal under experimentation in a feeding trial should be in just that condition as to surroundings as will conduce to the most favorable results. We must not hold to the idea that these creatures are passive and plastic in our hands; their natures and instincts are the results of ages of environment and keep, and it is perfectly useless to attempt to bring them to our ideas of how to live and what to eat in a short lifetime.

I would not belittle the chemist's side of our live-stock investigations, but I plead for the uplifting of the physical side of animal experimentation until it is placed on that high plain of intelligent recognition of the needs and conditions of each creature experimented on. Only when this has been accomplished can our feeding trials give results that will stand the test of time.

Mr. Gulley of Arizona presented the following paper:

The Number of Animals to be Used in Feeding Experiments.

The number of animals that should be used in a feeding experiment to secure data that may be useful and approximately reliable, is not easily determined. It is somewhat akin to the question of large *vs.* small plats in field tests with plants, and feeding for gain in weight or production of milk is perhaps more complicated than feeding for simple maintenance. We are, in fact, attempting to secure a scientific solution of a problem with several factors unknown, and at least one insolvable individual variation.

Mr. Webster when asked if he could not take any good Jersey cow and by judicious feeding secure the yield attained by several of his noted animals, is said to have replied, "No, I have handled from first to last several hundred and have found but one of each," mentioning four noted cows.

There is reason for claiming that more satisfactory results may be obtained from small rather than large field plats in testing fertilizers, varieties, etc., on the score of greater accuracy in work, if we are willing to admit that such work has any value more than to verify laboratory tests of plants; but to my mind it is taking large chances when we draw conclusions from results obtained from feeding one, two, or even three animals.

Without citing cases, I shall simply refer to feeding tests reported from this country and from abroad, and call attention to the wide range of variation between animals, and of the same animal at different times. If reports of the entire work of feeding animals at the experiment stations in this country were compiled and an attempt made to summarize results, we would have a mass of contradictory conclusions, of little value to the investigator and of practically no benefit to the economic feeder. Especially is this true of tests for the comparison of breeds, made with one or two animals of each breed. To a considerable extent this is due to a lack of facilities and skill in conducting the work, but greater than all to my mind is the uncertainty of the individual animals used in the tests.

Before going further I desire to state most emphatically that I disclaim any intention of criticising the work of my colaborers. I believe that no body of men in any country have ever shown more diligence and desire to do good and honest work than the experiment station men of this country since the stations were established. We have had many difficulties to contend with, but we are overcoming them.

I would make the minimum number of animals in a feeding test five, and consider this preliminary work, to be followed by a verification test with a minimum number of ten, and then if it is an economic feeding test, arrange with some practical feeder to test the results obtained on a still larger scale under some supervision of the station, with regard to quantities, weights, and other details.

Such feeding tests as I have suggested call for large equipment in plant and attendance, as the same attention must be given to each animal where ten are used as with one. This brings up a fundamental question which we must grapple with and determine wisely, if as a body we propose to utilize our resources to the best advantage.

It is reported that 27 stations are studying meteorology and climatic conditions; 31, soil—investigations of its geology, physics, chemistry, tillage, drainage, and fertilizers; 35, analyses of homemade commercial fertilizers, and field experiments with fertilizers; 39, methods of cultivation, manuring, and rotation, varieties adapted to different localities and purposes, and chemical composition and nutritive value; 24, composition of feeding stuffs, some of them making digestive experiments; 17, silos and silage; 24, feeding experiments for beef, milk, mutton, and pork, or different methods of feeding; 18, dairy work and milk investigations; 35, to a greater or less extent, horticulture; 25, injurious insects; 15, veterinary work; 6, sugar making.

To a great extent one station is the duplicate of another in the line of work adopted, and in three fourths of the stations the means that should be utilized to investigate one question are, to use a sporting phrase, "fired out of a big smooth-bore gun with a bell muzzle."

We, as members of this Association, are not responsible for this condition of things, but we shall be if it continues. College boards, local opinion, the demand that each industrial interest must receive attention, in short the necessity of gaining popular favor, has compelled us to spread over fields too large.

As training schools for young men the stations deserve great credit, but looked at simply from a business standpoint, as an investment by the country for investigation, while I believe we have returned to the people more than we have cost, we have not carried on this work in the most businesslike way. We did not have the men to start with, but we are getting them now, and to my mind the time has come for concentration and thorough work.

I have lived too long in the vicinity of the cotton plant to advocate a general control of the line of work of the stations, but I believe the time has come when as a body we should use our influence to concentrate the work of each station.

Nebraska has stepped to the front by appropriating $10,000 of the experiment station funds to one line of work. Suppose that four stations widely separated should for 4 years expend their entire resources in feeding experiments: Who does not suppose that much, yes, very much, more would be accomplished than in the twenty-four stations, where probably, taken together, an equal amount is expended in this work? Will not the same apply to all our work?

It may not be wise to expend the entire energy of the station in one line, but we might by mutual agreement make a beginning in apportioning the work, and then to have each station expend two thirds or probably three fourths of its means in one or at most two lines of work, using the remainder of the fund for such special investigation as may seem desirable.

Without this concentration feeding experiments can not, to my mind, be satisfactorily conducted unless our means are increased.

Mr. Armsby suggested that the factor of individuality might in some degree be eliminated by studying the same animals first through a period of feeding on a fodder having a wide ratio, and then on one having a narrower ratio.

Mr. Curtis remarked that there were often great variations in the same animal on the same food at different periods.

Mr. Morrow called attention to the fact that practical feeders got very contradictory results, as shown by the records of the fat stock shows.

In the general discussion the danger of impracticable work was illustrated by reference to a recently published series of experiments in which several animals were killed by feeding too exclusively on cotton-seed meal.

Mr. Hickman presented the plan of a cow stall recently constructed at his station, which led to a general discussion on the subject of stalls, floors, mangers, ties, etc. The Newton tie was commended by several persons.

On motion of Mr. Hunt, topics Nos. 5 and 8 were assigned to the general session for discussion.

On motion of Mr. Henry topic 12 was made the topic for discussion in this section on Friday.

Morning Session, Friday, August 14, 1891.

Mr. Ingersoll opened the discussion on topic 12, Variety testing in cereals, how can it be rendered more decisive? In this work the question must be studied from the standpoint (1) of the farmer, (2) of the miller, and (3) of the baker or consumer. This was illustrated by the history of the Clawson wheat in Michigan, which was condemned by the miller, though found much more productive than the ordinary sorts by the farmer. Next must be considered climatic conditions and soil variations. A variety may be suited to one climate but not to another and its adaptability can only be decided after a test of

several years. To eliminate the disturbance from variations in soil, a preliminary study of the soil under one variety was recommended, as also the duplication of the work on soils of entirely different character and over a series of years. It was especially urged that great care should be exercised in interpreting results.

Mr. Hickman presented the following paper:

VARIETY TESTING IN CEREALS, HOW CAN IT BE RENDERED MORE DECISIVE?

Variety testing of the cereals was discussed at our last annual meeting at Champaign, Illinois, more particularly in reference to the advisability of stations making this a prominent line of their work. Since it seems to be pretty generally decided that this work is a legitimate part of the station work, the next point to be discussed is the subject of this paper, namely, How can it be rendered more decisive?

As the amateur takes up this work he is sure to be disappointed in results because of a failure on his part to make a proper selection of soil upon which to do the work. The first point, then, that I would make as essential to more decisive results is that the selection of the soil should be made with the utmost care. This can not be done by a mere superficial survey before and after the land is plowed, but can be best done by taking a pick and shovel and digging holes to a depth of 5 or 6 feet at some three or four places in each and every acre used for a variety test. The purpose of these soundings is to define the depth of surface soil and to find the conditions of the subsoil—whether its composition is substantially the same throughout, and also to determine if the natural drainage of the land is regular and uniform.

If this first condition is overlooked our work in variety testing will be not only a decided failure, but the results will be wholly misleading. Should we find the natural fertility of the soil uniform and the variations in elevation only slight, the next point to be carefully considered is the drainage. Slight elevations and depressions may cause constant annoyances, but if the land is not by nature well drained, these annoyances will be multiplied tenfold. Therefore it is essential that systematic drainage be made a part of the preparation of land intended for the most decisive results in variety testing.

Having decided upon uniform soil and systematic drainage, the third point is to make the preparation of the land the same in all respects, plowing to a uniform depth, and all as near the same date as possible. Harrowing, rolling, etc., should be done with marked regularity.

The fourth point to be made is regularity in seeding, and this must be done by carefully grading the seed used. With wheat this can be rapidly and well done with a fanning mill such as the Monarch, which will give three grades of wheat, the first of which is quite uniform in size of the berry. This insures regularity in seeding, provided a good grain drill not too much worn be used.

With oats, grains of uniform size and weight can be most readily gotten by running through the fanning mill with a regular blast of wind sufficient to blow over the lighter grains. With corn, experiments have shown that it is not so essential to have the grains of uniform size. Experiments at our station lasting over a series of 4 years have not indicated any decided differences in yield between corn grown from the butts, middles, or tips of ears. Permit me to say here that I am not aware of any experiments being conducted that will prove any different results between using large and small grains of wheat, oats, barley, and other cereals, but until such experiments have been made the use of seed of uniform size is safer. If for no other reason it will insure regularity of seeding, and this is a very essential point in variety testing.

To conduct these variety tests in a single locality in any State will not warrant the experimenter in drawing general conclusions, but he must limit his deductions

on some points to results from that particular soil upon which he is working. Then to make our variety testing more decisive it is necessary that duplicate tests be made upon the different soils of the State. These tests should be conducted under the supervision of the stations, in fact by one trained at the station for such work. As I stated in my paper of last year, I believe the proper way to do this is for the stations to rent 8 or 10 acres of land, in as many different parts of the State as the case may warrant, for a series of 5 years, with an option of a further lease of 5 years, and put these lands under the direct management of a station officer. At the end of the first 5 years he may be able to decide pretty accurately what varieties are best adapted to certain soils. In fact not only would the experimenter be able to decide these points, but farmers having the data before them showing the results of the different varieties upon different soils for such a series of years could reduce the work to conclusions for themselves.

The mere fact of difference in yield from different varieties can not be attributed to variations of soils alone, but may be influenced by the crop preceding the one under consideration. It is therefore necessary that a system of rotation be conducted in connection with the variety tests in any locality.

Location may have much to do with the diseases to which the cereals are subject. This is also a point that can be studied only when the varieties are widely distributed and grown under varying conditions of soil and rotation.

To illustrate the point above indicated, namely, the variations in yield from different treatment of the soil, I may say that in a piece of oats grown this year at the Ohio Station there was a difference of 6 days between the ripening of the same variety of oats on plats side by side, one having been in corn last year and the other in barley. As the oats are not threshed yet I am not sure that it will make any variation in yield, but the point of difference in ripening is one worthy of some consideration.

I am of the opinion that when we find it necessary to manure our lands for variety tests it should be done with a manure spreader, because in this way it can be done much more regularly than by any other process.

In all cases our plats should be cut to a line at the ends, either in the fall or spring, and never left until harvest and then squared up with a cradle, because this method leaves room for two sources of error: The first is, we can not cradle to a line as accurately as we can hoe, and the second may creep in by a careless hand putting the cradled sheaves in with the main plat.

The harvesting of the grain in wheat, oats, rye, barley, etc., is a very laborious work, and this can be rendered more decisive only by the strictest personal supervision, trusting only to the coolest heads and having a still cooler head yourself to oversee the work done.

Our present system of threshing and calculating results may be sufficiently accurate, but if some one of our agriculturists would turn his attention to inventions and get up a thresher that would do our work with less labor it would be a lasting benefit to the cause.

There are some perplexing things in variety testing and there are some problems which I have not been able to cipher out.

One of these is: How shall we obviate in our plats longer straw and stronger growth on the edges than in the interior?

Summary.—Variety testing may be made more decisive—

(1) By selecting uniform soil.
(2) By systematic drainage.
(3) By careful, thorough, and uniform preparation of the soil.
(4) By testing on the different soils of the State and comparing results.
(5) By systematic rotation.
(6) By grading the seed used.
(7) By making the outlines of our plats strictly accurate.

(8) By the most careful and painstaking personal supervision, guarding against every possible point of error; and finally in making up data for publication by not trusting too much to the accuracy of a helper nor to yourself. Time spent in duplicating calculations and deductions is time well spent.

The reading of Mr. Hickman's paper was followed by a discussion on points of detail. Attention was called to a small threshing machine in use at Guelph, Ontario, in which the under part of the cylinder is hinged in such a manner that it can be opened for the more thorough cleaning out of the machine. Several gentlemen recommended the so-called "ground-hog" machine for threshing, while others preferred small separators.

The effect of the dividing spaces between plats on the outside rows was discussed. Mr. Blount had noticed that their effect is greater on plats running east and west than on those running north and south. He also stated that the largest grains of wheat are found not on the main stalks, but on tillers.

Assistant Secretary Willits was present during this session, and stated that it was expected that a very large number of varieties of wheat would be exhibited by the Department at the World's Columbian Exposition, and requested the section to appoint a committee of experts from their number to assist in identifying varieties in that exhibit.

On motion of Mr. Henry the section resolved to appoint such a committee at a future session.

The section then adjourned until 9:30 a. m. on Saturday.

Morning Session, Saturday, August 15, 1891.

On reassembling the section proceeded to the election of officers for the ensuing year, with the result that C. L. Ingersoll of Nebraska was chosen chairman, G. W. Curtis of Texas vice chairman, and T. F. Hunt of Pennsylvania secretary.

Mr. Morrow called the President elect to the chair and presented the following resolution, which was unanimously adopted:

Resolved, That the secretary of this section be instructed to convey to Chairman C. S. Plumb the appreciation of the members of the section of his services in preparing for this meeting, and their regret for the indisposition which has prevented him from taking part in its deliberations.

The Acting Chairman named the following gentlemen as members of the conference committee on wheat nomenclature, requested by Assistant Secretary Willits, subject to ratification by the general session: Messrs. Hunt of Pennsylvania, Roberts of New York, Vanderford of Tennessee, Plumb of Indiana, and Gulley of Arizona.

The section then proceeded to the discussion of the first topic on the program, How may fiber plants be studied to best advantage? Mr. Smith of Minnesota opening the discussion. Mr. Smith stated that the fiber of flax deteriorates unless fresh seed be frequently imported, and that experiments were in progress at his station with the object of

determining the best thickness of seeding, methods of culture, causes of disease, etc. He believed that the manufacture of flax must be developed simultaneously with its culture if any advance is to be made.

Mr. Smith was followed by a general discussion concerning present methods of cultivating, harvesting, and threshing flax and other fiber plants.

Messrs. Curtis and Gulley stated that a company now organized in San Francisco sells machines for decorticating ramie, taking a mortgage on the crop for the price of the machine.

Mr. Smith stated that a flax-pulling machine is working successfully in Minnesota.

Miss Charlotte Smith, president of the Woman's National Industrial League, Washington, D. C., appeared before the section and requested statistical information relative to the employment of women in agriculture.

The section then adjourned until Monday at 9:30 a. m., at which hour it adjourned *sine die*.

C. E. THORNE,
Secretary.

SECTION ON BOTANY.

MORNING SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order by the Chairman, B. D. Halsted.

Mr. R. Thaxter being absent, Mr. G. F. Atkinson was appointed secretary *pro tem.*

No program was prepared, and the Chairman, on motion of S. M. Tracy, called upon the members for volunteer papers.

Mr. Tracy suggested that it would be a good plan to discuss the preparation of the botanical exhibit for the World's Columbian Exposition. He stated that various subjects had been assigned to specialists at some of the stations and it would be well for workers to call upon others so that the exhibit of each might represent the work of the stations as a whole and not the individual work of the station. Station workers in botany would confer a favor by suggesting other lines of investigation that they were engaged in besides those already provided for. Each should estimate the amount of space their exhibit would be likely to occupy. The Department of Agriculture would probably provide uniform labels and also, probably, uniform size and quality of sheets. Botanists have shown great interest in undertaking the work.

An informal discussion followed as to the proper place for an exhibition of fungicides and spraying machinery. The general sentiment seemed to be in favor of a combined exhibit on the part of other sections so as to prevent needless duplication.

On motion of Mr. Tracy the following resolution was passed:

Resolved, That the section on botany call the attention of the various heads of the entomological, horticultural, and agricultural sections to the desirability of a collective exhibit of fungicides, insecticides, and spraying machinery in a single alcove.

Mr. Alwood made some remarks upon a recent severe attack of a fungous disease upon apple tree leaves in Virginia. Many trees lost from 50 to 75 per cent of their leaves, and the growth of young trees was greatly interfered with. It has increased in severity during the last 3 years. He exhibited specimens of the diseased leaves, and stated that he had not yet worked out the life history of the fungus. Experiment showed that the disease could be successfully checked by application of a weak solution of lime and bluestone when applied to the new growth.

Mr. Brewer exhibited an English walnut and a nut resembling a butternut. The gentleman who sent them to Mr. Brewer several years ago planted some English walnuts. One of the trees which grew where the seed was planted bears fruit resembling the butternut, while all the others bear English walnuts. The question arose as to whether or not it was a cross. In the discussion which followed it was suggested that perhaps the appearance of the butternut tree was accidental.

Mr. Garman presented through the Chairman a paper on A Bacterial Disease of Cabbages. The disease was characterized by a rotting of the interior of the cabbage heads. It was communicated to healthy cabbages by inoculation from the diseased ones. The author concludes it is due to the combined action of two different germs, and that hot weather accompanied by a high degree of humidity favors its development.

Mr. Alwood stated that he had observed the same disease in Virginia.

Mr. Atkinson spoke of a similar disease in turnips in Alabama.

Mr. Halsted spoke of the undesirability of planting cabbages and turnips in succession on the same ground when they were affected by *Plasmodiophora brassicæ*, and suggested that it might be equally undesirable in case of this bacterial disease.

Mr. Brunk spoke of *Cladosporium fulvum* on tomatoes in Maryland. He had treated it successfully with carbonate of copper 3 ounces, carbonate of ammonia 1 pound, and water 50 gallons. This strength does not scald the fruit.

Mr. Jones asked if there were good fungicides other than Bordeaux mixture.

Messrs. Brunk and Alwood spoke of the effectiveness of a weak solution of the Bordeaux mixture—2 pounds of copper sulphate, 2½ pounds of lime, and 25 gallons of water.

In the general discussion which followed the merits and demerits of various spraying machines were discussed.

Afternoon Session, Thursday, August 13, 1891.

The meeting was called to order at 2:30 p. m.

Mr. Atkinson presented some notes on diseases of the cotton plant, and exhibited several colored illustrations of the various diseases.

Mr. Brunk spoke of the use of the stereopticon in illustrating lectures before meetings of farmers, horticulturists, etc.

Mr. Halsted explained the use by himself of colored charts for a similar purpose.

In the general discussion which followed the feeling seemed to prevail that where possible the subjects should be illustrated both in bulletins and in lectures, and that colored illustrations were superior to plain ones.

Mr. Halsted described the method employed by himself in studying spore germination, using slides with concave ground centers.

Mr. Lazenby suggested the use of common salt cellars in place of the old watch glass. They are on the same principle as the Syracuse watch glass.

Mr. Alwood presented notes on the Artificial Pollination of Wheat. He showed the varieties of wheat artificially pollinated and the resultant crosses, and described in detail the method employed in the experiments.

Mr. Crandall exhibited the fruit of the wild service berry (*Amelanchier alnifolia*), and spoke of tests being made to determine the value and possibility of its domestication.

Afternoon Session, Friday, August 14, 1891.

The section was called to order at 2:30 p. m., and according to adjournment proceeded to election of officers for the ensuing year. G. F. Atkinson of Alabama was elected chairman and L. H. Pammel of Iowa secretary.

Mr. Pammel presented notes upon a Destructive Disease of Cherries by a *Cladosporium*, probably the same species as that found on the plum and peach. Damages reached 25 per cent.

An informal discussion followed upon the germination of seeds of *Vaccinium*; and upon the distribution of plants as governed by character of soil, by heat, moisture, etc.

Mr. Halsted read a paper entitled Notes upon *Monilia fructigena* and Spore Germination. The cherry fungus was collected upon excrescence of plum caused by *Taphrina pruni* in Mississippi. Inoculations were made upon cherries in moist chambers. The inoculations were successful and the cherries kept for checks remained sound. Inoculations also showed that the fungus would grow upon green and ripe tomatoes and upon various other vegetable substances, but more readily upon cherries. Experiments were made to test the germinating power of the spores in presence of a small amount of metallic copper. A thin piece of copper foil of the size of the end of a lead pencil was placed in the water in the cell culture. The spores failed to germinate. When nutrient fluid was added in the form of cherry juice they would germinate. The action of fungicides was further tested. Ammoniacal carbonate of copper compound was used in various strengths, beginning with the strongest, *i. e.* 3 ounces carbonate of copper to 1 quart ammonia. Spores were killed by this; also by the half, fifth, and twentieth strength. Next, 1 part of the fungicide of vineyard strength was added to 99 parts water. Spores would not germinate, but when washed with pure water several times they would germinate. From this study the practical question arises whether far weaker solutions of copper sulphate than now used would be equally successful.

Mr. Atkinson spoke of attempts to germinate spores of *Cercospora gossypii*, Cooke, in a Van Tieghem cell, which had been sterilized by washing with a one tenth per cent solution of mercuric chloride. Care was taken that the nutrient agar-agar on the cover glass did not come in contact with any part of the cell sterilized by the mercuric chloride. In no case did the spores germinate when the cell was sterilized by mercuric chloride, but when sterilized by heat they germinated readily.

Mr. Sturgis of Connecticut spoke of similar experiences encountered by him when making cultures of lichens.

The section adjourned *sine die.*

G. F. Atkinson,
Secretary pro tem.

SECTION ON COLLEGE WORK.

MORNING SESSION, THURSDAY, AUGUST 13, 1891.

The meeting was called to order at 9:30 a. m., the section organizing, in the absence of its regular officers, by the appointment of W. L. Broun of Alabama as chairman and H. E. Stockbridge of North Dakota as secretary.

President Alvord, chairman of the executive committee of the Association, presented a letter from the chairman of the section, President Atherton of Pennsylvania, proposing two topics for the consideration of the section, namely, Waste in college work, and To what extent can manual labor be advantageously introduced into the curriculum of land grant colleges? Consideration of these subjects was postponed, and by request President Alvord made a statement to the section of the present status of the Association and the institutions belonging thereto, with regard to the Congressional appropriations under the Morrill law, particularly the third or $17,000 installment, now overdue.

A circular letter under date of August 13, signed by the Commissioner of Education, was presented to the Association, pertaining to the annual reports of college presidents and treasurers called for by the act of August 30, 1890, and due on or before September 1. The conditions adopted by the Bureau of Education as governing the matter and form of these reports gave rise to an animated and very general discussion, eliciting the fact that the conditions imposed, particularly those requiring a "detailed statement of the amount so received and its disbursement," were unanimously believed to be impracticable, and it was thought best that an effort be made towards securing a different interpretation of the law from the Department of the Interior. It was, therefore—

Resolved, That a committee of five be appointed to confer with the Secretary of the Interior in reference to the payment of the installment unpaid and now due, under the act of Congress approved August 30, 1890, and further that this committee be instructed to confer with the Commissioner of Education concerning the revision of the circular letter of this date (August 30, 1891), issued by the Bureau of Education to the presidents and treasurers of agricultural colleges, and also concerning forms for the reports of the presidents and treasurers of these institutions.

The committee appointed in accordance with this resolution consisted of Messrs. Alvord of Maryland, Scott of Ohio, Johnson of Wyoming, Buckham of Vermont, and Porter of Missouri.

The section then adjourned until Friday at 9 a. m. to give the above committee a chance to confer with the Department of the Interior and report.

Morning Session, Friday, August 14, 1891.

The section convened as per adjournment. President Alvord of the committee made a report of progress, narrating the result of the interview of the committee with the officers of the Department of the Interior and the Commissioner of Education, whereby the information was obtained that the papers for the $17,000 payment to the different institutions named as beneficiaries under the act of August 30 had been drawn and were retained in the office of the Secretary of the Interior, and that the assurance of the Department was offered that the delay in the payment of this installment in no way emanated from the institutions concerned, but resulted wholly from technicalities in the Department itself, and that an early payment, probably during the month of September, was certain.

Following the report of this committee the section proceeded to the consideration of the two subjects proposed by its president. By vote, consideration of the first question, Waste in college work, was postponed for 1 year. The second subject, To what extent may manual labor be introduced into the curriculum of land grant colleges? was then called for, and in the absence of Professor Massey of North Carolina the paper prepared by him on this subject was read by his colleague, Professor Emery, as follows:

Manual Labor in Agricultural Colleges.

Of late years a great deal has been written and said in regard to manual training, and many people who mean well, but who have not studied the conditions nor had any experience as teachers, imagine that instruction in a college of agriculture should be upon the same plan as that of a mechanical training school. They mistake an agricultural college for a farm-training school, and the profession of agriculture for a handicraft. They go upon the hypothesis that to be a skillful farmer it is necessary for a man to be an expert farm hand in all the farm operations where manual dexterity is important. Even if this were the case, a college is not the place to acquire this dexterity.

Prof. L. H. Bailey struck the keynote in a recent editorial in the columns of the *American Garden*, when he said that a student should be prepared for college before entering, and that these minor operations of plowing, handling teams, mowing, etc., should be acquired before the student comes to college. The attempt to teach these things at an agricultural college usually amounts to a complete farce and a waste of time which could be more profitably devoted to matters more valuable to the student. The practice at some colleges of making field labor compulsory for a certain number of hours daily, and at the same time paying the students for doing it, is simply an acknowledgment that the work is not educational. The plain fact is, if you will pardon the slang, it is simply done for "buncombe," to make a show of doing practical work to be seen of men, and thus to enable the college to get

appropriations from the legislature to pay for this perfunctory work, and enable students to pay their board in an institution where tuition is already free. It is in fact pure demagogy, and no one knows it better than the faculties of these colleges if they speak out their real sentiments on the subject.

As Professor Bailey says in the editorial referred to, the manual labor necessary in a college course in agriculture and horticulture is such as can properly come under the head of laboratory work, such as improved methods in dairy management and the manufacture of butter and cheese, the microscopic and chemical work in connection with these, practice in veterinary surgery, the management of plants under glass, their hybridization and improvement, those operations of a like character in the orchard and garden in which manual dexterity and scientific skill go together, and the botanical and chemical laboratories. All these are educational and important, but to have a band of students spending hours daily in the performance of set tasks at which the most unintelligent of farm laborers will always be their equal, and generally their superior, is, I have always insisted, a wicked waste of time and public money. It is not dignifying labor, as so many insist, but a belittling and prostitution of mental culture. Men say, "I want my son to be taught to work." Well, if your son has not been taught to work before coming to college, he lacks the industry to make him successful as a student, for a man who is lazy in one kind of work is usually lazy all the way through, and the kind of work necessary for a student to perform requires a higher degree of industry than that which belongs to a mere "hewer of wood and drawer of water."

"But you will educate the boys away from the farm." This is just what the hoeing, digging, and plowing colleges have been doing, and this is what colleges of real practical agriculture will put a stop to. Statistics show that in colleges thoroughly equipped for their work, and in which the laboratory methodsare used and the minor manual operations merely incidental, a much larger proportion of the students enter agricultural occupations than from the best of those where compulsory and paid manual labor is the rule. Professor Bailey says: "The graduates from the Cornell College of Agriculture, and they are as many as from any bona fide agricultural school in the country, *all* follow agricultural pursuits." And yet the compulsory paid manual labor system has no place at Cornell. I do not want it to be supposed that I oppose the teaching of all farm operations in an agricultural college. They should be taught, but no further than they are educational and necessary for the proper understanding of the subject at the time in hand, all partaking of the nature of laboratory work. Nothing further than this should be attempted. The effort to make skillful farm laborers at such an institution will necessarily result in failure, lower the educational standard of the college, and as a consequence turn out men with a narrow and incomplete education.

The effort in some places to give this purely *practical* character, as it is improperly called, to the college, has already resulted in a narrowing of the course of study, which can not fail to result in a lower degree of education. All languages except English are ignored, particularly the ancient languages. This is contrary to the spirit and intent of the organic law of these colleges, in fact contrary I think to its plain letter. The dead languages are used so largely in all scientific terminology that a student who is totally ignorant of Latin and Greek is fearfully handicapped in his work, and can never make the same progress as one who has the advantage of a knowledge of the structure of those languages; and if he proposes to keep well abreast with modern scientific research, a knowledge of French and German is highly desirable. But with his afternoons rigidly devoted to the perfunctory performance of the tasks which belong simply to the ordinary drudgery of the farm, he has no time for these; while he is out "dignifying labor" he is cheating his mind and narrowing his intellect.

This phrase, "dignity of labor," makes me lose patience with those who are continually uttering it on the rostrum and writing it for the press. Is ordinary intelligent labor the only labor worth "dignifying?" Is there no labor but that of

the hands? Are we to prostitute intellectual labor in order to get it down to the level of the farm hand? Ought we not rather to ennoble the labor of the hand by making it a necessary agent in carrying out mutual training—do for agriculture on the farm what the laboratory does for chemistry? Ennoble labor for education's sake, but for humanity's sake do not debase education for labor's sake.

The paper was listened to with great interest, and was followed by a general and very animated discussion, in which, while the general tone of the paper was commended, several of the opinions and statements made were challenged, among the statements elicited being one showing by actual analysis that the purely agricultural colleges were sending 34 per cent of their graduates back to the farm as actual practical farmers, and that doubtless a larger percentage of the graduates of these institutions followed the profession for which the institutions were maintained than could be claimed for the graduates of the professional schools of any other calling. At the close of the discussion the section adjourned to Saturday morning at 9:30.

Morning Session, Saturday, August 15, 1891.

The section was called to order by the Chairman at 9:30 a. m.

President Alvord rendered a final report of the results of the interview of the committee with the officials of the Department of the Interior, embodying a form of report for college treasurers, which was acceptable to the Department and adopted by the section as the form recommended for use. Mr. Johnson of Wyoming, as a subcommittee, reported the form recommended for the reports of college presidents.

It was voted that the section recommend to the general session of the Association that a committee of three college presidents be added to the standing committee of the Association on representation of the agricultural colleges and experiment stations at the World's Columbian Exposition.

Mr. Alvord called the attention of the section to the ruling of the War Department respecting the detail of officers as instructors in land grant colleges.

No other business coming before the section, nominations for officers for the ensuing year, to be presented to the general session of the Association, were made as follows: E. M. Turner of West Virginia, chairman; C. H. Pettee of New Hampshire, vice chairman; H. E. Stockbridge of North Dakota, secretary. These officers were by vote constituted the executive board of the section, which then adjourned *sine die*.

H. E. Stockbridge,
Secretary.

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PUBLICATIONS OF THE STATIONS AND OF THIS OFFICE.

Each station issues bulletins and annual reports, which are sent free of charge to citizens of its own State, and, so far as practicable, to applicants from other States. The work of the stations is also summarized in publications of this Office.

The Office of Experiment Stations issues two classes of publications for general distribution:

(1) Farmers' Bulletins, which are brief and popular in character, and are sent on application.

(2) Experiment Station Bulletins, Miscellaneous Bulletins, and the Experiment Station Record, which are more or less technical. It is the practice to send to persons applying for them one or more numbers, from which they may judge of their usefulness, but not to place any names upon the mailing list until after receipt of applications on special blanks furnished by the Office.

The following bulletins have been issued:

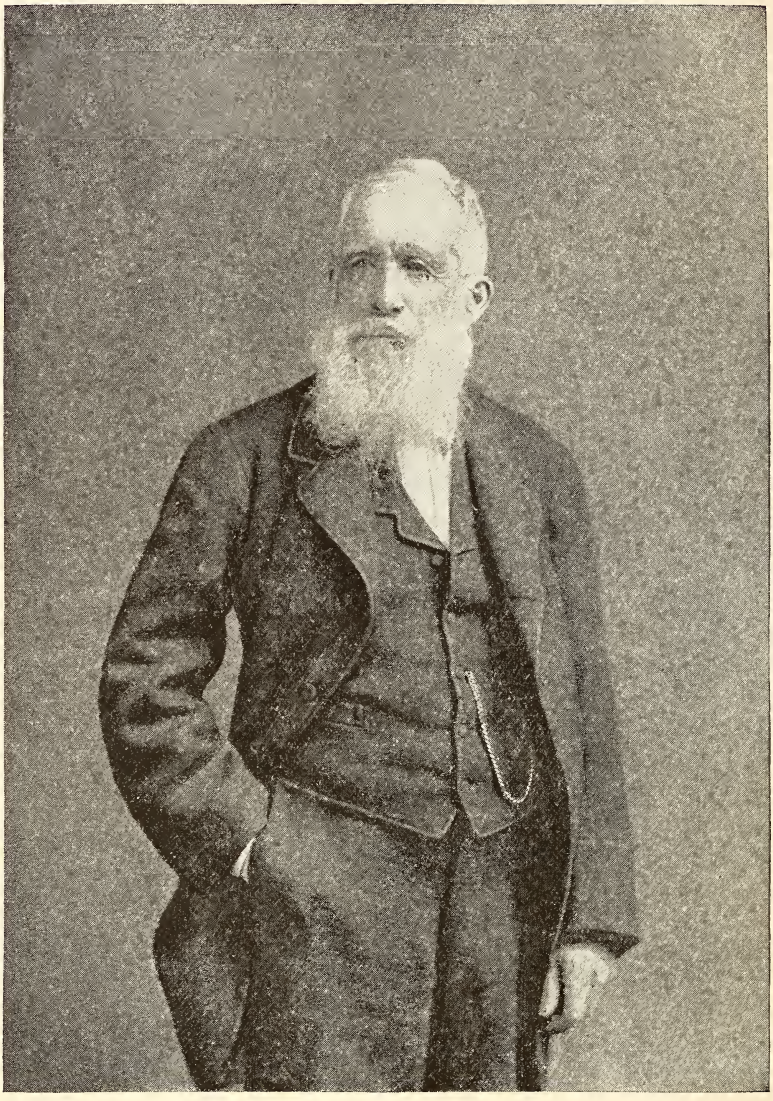
Farmers' Bulletins.—No. 1, The What and Why of Agricultural Experiment Stations; No. 2, Illustrations of the Work of the Stations.

Experiment Station Bulletins.—No. 1, Organization and History of the Stations; No. 2, Digest of Annual Reports of the Stations for 1888, in two parts; No. 3, Report of Meeting of Horticulturists at Columbus, Ohio, June, 1889; No. 4, List of Station Horticulturists and Outline of their Work; No. 5, Organization Lists of Stations and Colleges, March, 1890; No. 6, List of Station Botanists and Outline of their Work.

Miscellaneous Bulletins.—No. 1, Proceedings of Knoxville Convention of Association of Agricultural Colleges and Stations, January, 1889; No. 2, Proceedings of Washington Convention of the Association, November, 1889; No. 3, Proceedings of Champaign Convention of the Association, November, 1890.

The Experiment Station Record, vol. I, 6 numbers; vol. II, 12 numbers; vol. III, Nos. 1–7. Copies of the station and Department publications abstracted in the Record can, in many instances, be obtained on application.

Communications intended for this Office should be addressed to the SECRETARY OF AGRICULTURE, for the *Office of Experiment Stations, Department of Agriculture, Washington, D. C.*



SIR J. B. LAWES, BART.
1891.